21 July 2020
Equity Research
Asia Pacific

CREDIT SUISSE

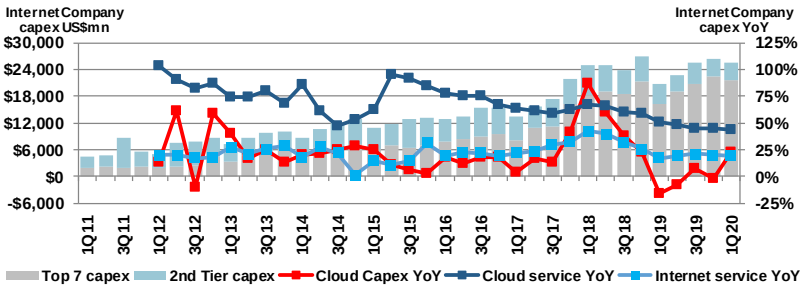
Global Technology

Cloud computing: The next frontier

Technology | Connections Series

Connections Series

Figure 1: Cloud capex a new tech driver the past decade with legs for further growth



Source: Company data, IDC, Credit Suisse estimates

- **From data creation to data analytics: a major inflection driving structural growth in the data centre.** While a solid 26% CAGR for data cited by Cisco is an old theme, what is new is our ability to monetise data, with AI and Machine Learning being the first technology to lower analytics costs, potentially unlocking the potential for 99.5% of data that has remained dark, leading to an accelerating application workload growth and an accelerating compute TAM. We estimate a US$90 bn compute TAM will accelerate from a 3-5% CAGR to 10-15% CAGR over the next five years. While we may see a 1-2 quarter capacity digestion in late 2020, following five quarters of strong data centre builds, the purpose of this report is to define and explore long-term trends and the supply chain underpinning the move to a data economy as a secular multi-year tailwind to growth.
- **Cloud as a new ecosystem driver.** Cloud IT infrastructure spending is delivering a 10% CAGR, vs -1.2% CAGR for traditional IT infrastructure, driven by the rising number of connected devices and video applications, proliferation of cloud services for enterprise and consumer, and accelerating AI data analytics. The rise of hyperscale and cloud service providers has supported the rise of an ODM Direct model, rising 10x from 2011-19 and growing from low single digits to 24% of servers and 6% of networking. We expect growth to continue, with cloud servers maintaining +15%/+14% YoY unit growth in 2020-21, well above -2%/+9% overall server growth, supporting outgrowth for the ODM Direct hardware makers, merchant silicon and components with leverage to the data centre theme.
- **Supply chain opportunities**. Key hardware beneficiaries include ODMs building out Open Compute Project (Quanta, Wiwynn), and hardware components supporting data centre design changes (Delta, FII, Hon Hai, Shengyi). Within semiconductors, foundry and fabless gain in HPC (TSMC, Aspeed), memory (Samsung, Micron and SK Hynix) from rising data centre storage and IC design service companies (Alchip) supporting system company and China upstarts designing complex HPC chips. In the US semis our picks are NVIDIA, Intel, AMD and Xilinx. While the shift to cloud infrastructure is a negative for US Hardware OEMs, IBM and NetApp are better positioned in a hybrid-first world. Amongst datacentre operators, we like Equinix, Digital Realty and Switch (globally) and GDS and VNET (China) and in Japan we prefer Anritsu (5G) and Renasas (data centre and auto).

The Credit Suisse Connections Series leverages our exceptional breadth of macro and micro research to deliver incisive cross-sector and cross-border thematic insights for our clients.

Research Analysts

Randy Abrams, CFA
886 2 2715 6366
randy.abrams@credit-suisse.com

Jerry Su
886 2 2715 6361
jerry.su@credit-suisse.com

Manish Nigam
852 2101 7067
manish.nigam@credit-suisse.com

John W. Pitzer
212 538 4610
john.pitzer@credit-suisse.com

Contributing analysts

Akinori Kanemoto
Chaolien Tseng
Colin McCallum
Dalya Hahn
Haas Liu
Harvie Chou
Hideyuki Maekawa
Kenneth Fong
Keon Han
Kyna Wong
Matthew Cabral
Nicholas Teh
Pauline Chen
Sami Badri
Sanguk Kim
Tina Long

DISCLOSURE APPENDIX AT THE BACK OF THIS REPORT CONTAINS IMPORTANT DISCLOSURES, ANALYST CERTIFICATIONS, LEGAL ENTITY DISCLOSURE AND THE STATUS OF NON-US ANALYSTS. US Disclosure: Credit Suisse does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that the Firm may have a conflict of interest that could affect the objectivity of this report. Investors should consider this report as only a single factor in making their investment decision.

VISIT…

扫码免费领取资料

房中术(www.zuihaoziyuan.com)专注于男性增大增粗增长、阳痿、早泄、壮阳、延时、强肾、回春、健身。女性缩阴、丰胸、减肥、化妆、瑜伽、保养、产后修复、盆底肌锻炼。两性健康,夫妻按摩,房中术,性姿势,性技巧,性知识等

更多免费教程：英语学习，技能提升，PS 教学，投资赚钱，音乐教程，口才教学，情商提升，风水教学，心理学，摄影知识，幼儿学习，书法学习，记忆力提升等等.....

==========

全站课程下载

课程不断增加

本站现资源容量已超 10T

入群联系 QQ：167520299 或添加微信：1131084518（备注PDF）

扫码加微信lax988988领取资料

阳痿早泄训练
皇室洗髓功视频教学
女人驻颜术
泡妞约炮万元课程
足疗养 SPA 教材
玉蛋功
马氏回春功
房中术张丰川
哲龙全套视频
增大盼你增大
国际男优训练
亚当德永早泄训练
洗髓功真人内部
皇室养生绝学道家洗髓功
【铁牛人会员课】男人必备技能，理论讲解
实战高清视频
随意控制射精锻炼 视频+图片+文字
价值 1440 元第一性学名著<素女经房中养生
宝典视频>12 部
洗髓功修炼方法视频教学
陈见玉蛋功视频教学 女性缩阴锻炼
男性自然增大增长指南
强性健肾保健操 1-4
道家强肾系统锻炼功法
马氏回春功
12 堂课，全面掌握男性健康问题 让你重燃自信
联系微信：1131084518

1、东方性经
2、印度 17 式
3、口交技巧 3 部
4、港台性姿势 3 部
5、365 性姿势 6 部
6、泰国性爱密经 17 式
7、花花公子性技巧 6 部
8、阁楼艳星性技巧 7 部
9、古今鸳鸯秘谱全集 7 部
10、夫妻爱侣情趣瑜伽 2 部
11、古代宫廷性保健系列 14 部
12、汉唐宋元明清春宫图真人
13. 柔软性爱宝典 日本 9800 课
14. 李熙墨 3999 全套课
15. 妖精性爱课 2888
16. 李银河全套性课
17. 领统统性课
18. 德勇男性篇
19. 德勇男性篇
20. 缓慢性爱
21. 亚当多体位搭配篇
22. 亚当多体位结合篇
23. 德勇克服早泄讲座练习
24. 德勇以女性为中心得爱抚
25. 加藤鹰接吻爱抚舌技
26. 加藤鹰指技
27. 加藤鹰四十八手入门
28. 佐藤潮吹教学
29. 佐藤男人体能锻炼+保健品介绍
30. 佐藤男人早泄对抗训练
31. 阿拉伯延时训练

32. 田渊正浩秘籍
33. 异性性快感集中训练教学
34. 自我愉悦锻炼密宗
35. 铁牛全套延时训练课
36. Pc 机锻炼真人视频教学
37. 印度性经全集 8 部
38. 21 世纪性爱指南
39. 香蕉大叔男女训练馆全套
40. 中美真人性治疗教学+理论
41. 女性闺房秘术
42. 幸福玛利亚性课
43. 陈见如何释放性魅力征服
44. 性爱技巧讲座全套
45. 性爱秘籍全套
46. 性爱误区讲座
47. 性病讲解大全
48. 性博士讲座合集
49. 性健康和性高潮合集
50. 性教育讲座合集
51. 性能力课堂合集
52. 性生活问题解析合集
53. 意外怀孕和避孕处理课堂
54. 性感地带探索
55. 性技巧讲座
56. 性健康与性卫生讲座
57. 性生活专家答疑
58. 性心理与性道德合集
59. 性爱宝典合集
60. 性爱技巧合集
61. 完美性爱演示
62. 完美性爱技术讲解
更多精品等你来解锁哦.....

每日免费获取报告

1、每日微信群内分享**7+**最新重磅报告；

2、每日分享当日**华尔街日报**、金融时报；

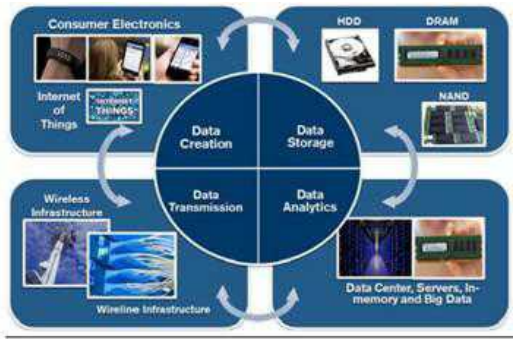
3、每周分享**经济学人**

4、行研报告均为公开版，权利归原作者所有，起点财经仅分发做内部学习。

扫一扫二维码
关注公号
回复：**研究报告**
加入“起点财经”微信群。。

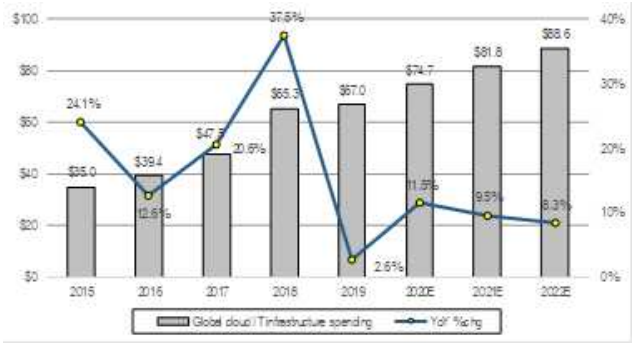
Focus charts and tables

Figure 2: Data growth—self-perpetuating dynamic



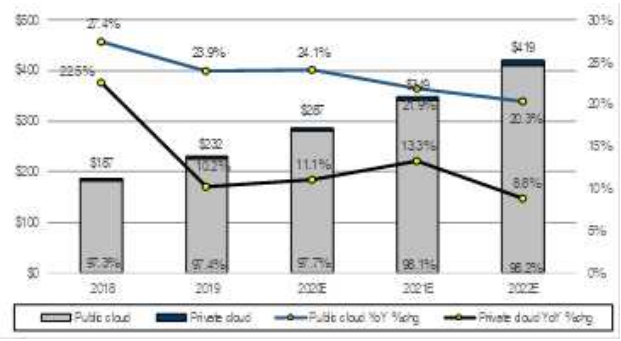
Source: Credit Suisse

Figure 3: Global cloud infrastructure to deliver a 10% CAGR



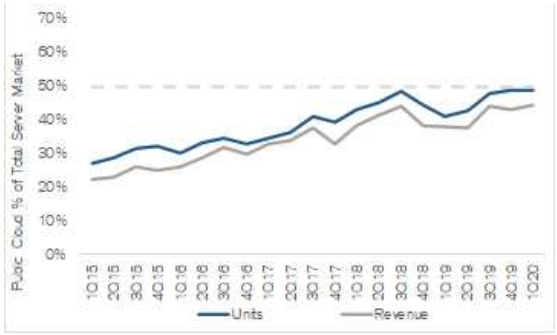
Source: Company data, IDC Credit Suisse

Figure 4: Cloud services 21% CAGR to US$419 bn by 2022



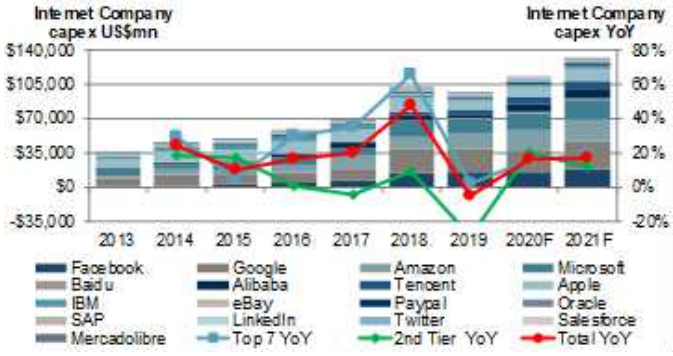
Source: Company data, IDC, Credit Suisse

Figure 5: Public cloud to surpass enterprise servers in CY20



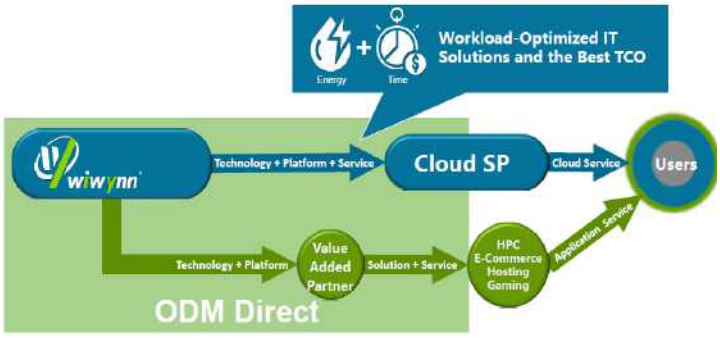
Source: IDC, Credit Suisse

Figure 6: Cloud capex projected for teens growth in '20/21



Source: Company data, Credit Suisse

Figure 7: ODM Direct model enabled by hyperscalers/CSPs



Source: Company data

Figure 8: Cloud builds strong in 2020/21 even with a late year pause

NT$bn/BMC (mn)	1Q20	2Q20	3Q20E	4Q20E	1Q21E	2Q21E	3Q21E	4Q21E	2017	2018	2019	2020E	2021E
Inventec	12.4	20.0	22.0	18.0	16.0	22.0	24.0	22.0	43.0	63.0	63.1	72.4	84.0
Quanta	35.0	37.9	47.6	47.6	42.0	43.2	54.7	55.2	102.2	125.1	144.5	168.0	195.1
Wiwynn	35.1	52.1	55.3	56.6	53.6	64.8	67.6	65.6	85.7	181.1	163.6	199.1	251.6
MiTAC	6.8	9.0	9.2	8.8	8.5	10.6	11.4	10.8	40.6	22.0	26.6	33.8	41.4
Accton	5.5	6.1	7.0	7.8	6.6	7.9	9.3	8.3	14.2	18.5	25.9	26.3	32.1
Total	**94.8**	**125.0**	**141.1**	**138.7**	**126.7**	**148.5**	**167.0**	**161.9**	**285.7**	**409.7**	**423.7**	**499.6**	**604.2**
QoQ	***-22%***	***32%***	***13%***	***-2%***	***-9%***	***17%***	***12%***	***-3%***					
YoY	***4%***	***19%***	***34%***	***14%***	***34%***	***19%***	***18%***	***17%***	***54%***	***43%***	***3%***	***18%***	***21%***

Source: Company data, Credit Suisse estimates

Cloud computing: The next frontier

Increasing workload shift to the cloud

Cloud IT infrastructure spending has grown faster (~17.5% CAGR) than global IT infrastructure spending (~6.5% CAGR) over 2015-19, and represents ~50% of total IT infrastructure spending. IDC forecasts that the cloud IT-mix will grow to 60% of that spending by 2022, implying a 10% CAGR vs. a -1.2% for traditional IT infrastructure. Cisco expects consumer IP traffic to grow even faster at a 26% CAGR (2019-22, representing 83-84% of traffic, with business IP traffic growing at a 23% CAGR. We see three enablers of this shift to the cloud: (1) increasing number of connected devices (this gets a further boost with the ramp up of 5G in the forthcoming years) and a rapid rise of video applications; (2) proliferation of services on the cloud accelerating data consumption in businesses, and (3) accelerating AI data analytics.

Cloud IT spending is now ~50% of total global IT infra spend…

…and is expected to still grow at a 10% CAGR over 2019-22E

Cloud is driving growth for hyperscalers

Cloud servers have outpaced the server market due to much stronger hyperscale and public cloud demand, delivering a 23% CAGR from 2015-18 vs. a 7% server unit CAGR. This part of the market is seeing a further boost from COVID-19-related acceleration in applications from on-premise to cloud. We forecast public cloud server unit growth of 15%/14% YoY in CY20/21, near our bottom-up growth in hyperscale capex at +17%/+17% in that period and outpacing our server unit forecast for -1.9%/+8.7%. Overall, Cisco estimates there will be in total 628 hyperscale data centres by the end of 2021, vs 509 in 2019, for an 11% CAGR growth. Thus, servers residing in hyperscale data centres are expected to make up over 50% of the total installed servers in data centres globally by 2021 (from 44% in 2019), representing 85% of the total public cloud servers and 87% of public cloud workload and compute instances.

An increasing workload shift to the cloud has in turn been driving growth for the hyperscalers

Public cloud server unit growth of 15%/14% YoY in CY20/21; hyperscale capex growth of 17% YoY in both the years

Rise of the ODM model and merchant silicon

As markets increasingly shift to adopt open-sourced platforms for greater optimisation of the total cost of ownership, starting from hyperscalers and CSPs, and followed by enterprises/ telcos longer-term, Taiwan cloud IT infrastructure ODMs have been key beneficiaries. ODMs' enhanced sophistication in custom hardware design, flexibility in mass-scale manufacturing, and system integration and comprehensive after-market services coverage globally have helped them gain share at hyperscalers. The combined sales made by ODM Direct in servers increased by 10x over 2011-19, driving their combined share to over 24% in 2019 (just 4% in 2011). This trend is set to continue with the rising share of hyperscalers in the overall server mix. As the datacentre infrastructure's innovation cycle gets disrupted, large operators' demand cannot be served by the traditional model (OEMs' collaboration with silicon vendors). In response to this challenge, major OEMs are incorporating merchant silicon and supporting open standards.

ODM Direct in servers to continue to gain share; Taiwan ODMs the key beneficiaries

The trend is also necessitating server OEMs to support merchant silicon and open standards

Supply chain opportunities

The cloud/datacentre opportunity benefits parts of the technology supply chain globally and is likely to grow significantly as the development of 5G further accelerates existing trends. Within Asian downstream, certain ODMs are key beneficiaries, supported by further proliferation of the Open Compute Project (Quanta, Wiwynn). The shift to cloud infrastructure is a negative for US Hardware OEMs, though we like IBM and NetApp's positioning in a hybrid-first world. Significant design changes for components requiring the ability to deal with high bandwidth, low latency and massive connectivity leads to opportunities for names such as Delta, FII, Hon Hai and Shengyi in China. Within semis, IC Design and advanced foundry get a lift from HPC (TSMC, Aspeed) and IC design service companies (Alchip) are providing design support to help system and fabless companies to design these complex HPC chips. In the US, top picks on the accelerating compute TAM are NVIDIA, Intel, AMD, Micron and Xilinx. Our Japan top picks are Anritsu on 5G device testing and Renasas on rebound in auto and from data centre. Public cloud service growth from hyperscalers will support server DRAM growth (now 35% of memory), supporting the memory demand side (Samsung, SK Hynix and Micron). Amongst datacentre operators, globally we highlight Equinix, Digital Realty and Switch and in China, GDS and VNET.

Given the scale of the cloud/datacentre opportunity, several stocks are leveraged to the theme—full list on the next page

Key stock picks

Figure 9: Global technology suppliers leveraged to cloud data centre growth

Name	Ticker	Rat	Curr.	Price (LCY)	Target Price	Mkt cap (USD mn)	PE (x) 2020	PE (x) 2021	EPS growth (%) 2019	EPS growth (%) 2020	EPS growth (%) 2021	Yield (%) 2020	PB (x) 2020	ROE (%) 2020
Asian Hardware														
Accton	2345.TW	N	TWD	236.50	240.00	4,500	26.1	20.1	67.3	2.4	30.3	2.9	9.2	35.4
Delta Electronics	**2308.TW**	**O**	**TWD**	**184.00**	**208.00**	**16,037**	**23.7**	**20.5**	**27.1**	**(13.8)**	**15.9**	**3.0**	**3.2**	**13.6**
FII	**601138.SS**	**O**	**CNY**	**14.79**	**17.00**	**43,486**	**16.9**	**14.9**	**9.2**	**(3.4)**	**13.2**	**1.2**	**3.0**	**17.6**
Hon Hai	2317.TW	O	TWD	88.00	93.00	40,819	12.2	10.7	3.6	(14.3)	14.2	4.6	1.0	7.8
Inventec	2356.TW	N	TWD	24.75	24.00	3,061	10.5	13.7	(15.3)	56.4	(23.3)	6.6	1.7	15.8
Lenovo	0992.HK	N	HKD	4.55	4.50	7,098	10.6	8.5	11.3	0.4	23.8	5.4	1.6	14.9
MiTAC	3706.TW	N	TWD	29.55	32.20	1,214	12.9	9.2	(14.2)	(1.9)	40.3	3.0	0.9	6.9
Quanta	**2382.TW**	**O**	**TWD**	**78.00**	**90.00**	**10,351**	**17.2**	**14.7**	**5.5**	**11.0**	**17.4**	**5.9**	**2.2**	**12.8**
Shengyi Tech	**600183.SS**	**O**	**CNY**	**29.00**	**48.10**	**9,727**	**35.1**	**27.2**	**25.5**	**29.2**	**28.9**	**1.8**	**5.6**	**16.0**
Shennan Circuits	002916.SZ	N	CNY	162.67	194.60	11,281	45.9	36.5	58.6	(8.9)	25.9	0.7	12.7	27.7
Wiwynn	**6669.TW**	**O**	**TWD**	**753.00**	**960.00**	**4,727**	**17.4**	**11.8**	**(2.1)**	**16.6**	**47.6**	**3.9**	**5.3**	**34.6**
ZTE	0763.HK	O	HKD	23.00	26.10	25,026	19.1	14.4	- to +	(9.1)	32.6	0.9	2.9	15.3
Asian Semiconductors														
Alchip Tech	**3661.TW**	**O**	**TWD**	480.00	630.00	982	30.5	22.5	71.9	114.5	35.5	0.7	7.1	23.3
Amkor	AMKR.OQ	N	USD	12.16	12.00	2,932	18.2	15.3	(5.0)	33.0	18.7	0.0	1.4	7.6
Anritsu	6754.T	O	JPY	2,435.00	2,880.00	3,159	21.3	20.6	35.0	31.4	3.3	1.4	3.2	15.1
ASE	3711.TW	O	TWD	69.30	84.00	10,381	11.8	10.9	3.8	12.7	8.3	3.4	1.4	12.2
Aspeed	**5274.TWO**	**O**	**TWD**	1,255.00	**1,300.00**	**1,480**	**41.8**	**34.5**	**20.7**	**25.1**	**21.3**	**1.6**	**18.4**	**44.0**
GUC	3443.TW	N	TWD	284.00	250.00	1,325	72.8	33.9	(35.9)	(15.3)	114.9	1.7	8.9	12.3
MediaTek	2454.TW	O	TWD	607.00	730.00	32,393	29.7	20.2	31.6	39.2	47.0	1.7	3.1	10.3
Parade	4966.TWO	N	TWD	1,075.00	970.00	2,795	26.3	22.3	22.3	27.9	18.2	1.5	6.2	23.4
Renesas	6723.T	O	JPY	593.00	1,290.00	9,545	10.8	9.5	(50.0)	262.7	13.8	0.0	1.4	13.0
Samsung Elec	**005930.KS**	**O**	**KRW**	**54,400**	**65,000**	**268,891**	**15.4**	**11.0**	**(51.0)**	**10.0**	**40.0**	**2.6**	**1.4**	**8.8**
SK Hynix	**000660.KS**	**O**	**KRW**	**82,900**	**118,000**	**49,731**	**13.0**	**6.9**	**(87.0)**	**114.4**	**87.7**	**0.0**	**1.1**	**8.1**
TSMC	**2330.TW**	**N**	**TWD**	**367.00**	**365.00**	**321,942**	**20.3**	**20.1**	**(1.7)**	**35.2**	**1.1**	**2.7**	**5.2**	**25.7**
Global Hardware														
Dell	DELL	N	USD	60.37	44.00	44,723	11.4	9.6	16.9	(28.1)	19.2	0.0	9.0	79.1
HPE	HPE	U	USD	9.67	8.50	12,424	8.0	7.4	19.7	(31.4)	7.5	5.0	1.0	12.3
IBM	IBM	O	USD	125.11	150.00	111,084	11.5	10.1	(7.3)	(15.0)	13.2	5.4	5.0	43.2
NetApp	NTAP.OQ	O	USD	44.81	53.00	9,940	13.1	10.2	(9.2)	(16.4)	28.8	4.3	9.4	72.1
Global Semiconductors														
AMD	AMD.OQ	N	USD	55.04	33.00	64,462	66.7	46.8	55.5	63.4	42.5	0.0	19.2	28.7
Broadcom Ltd	AVGO	O	USD	312.71	400.00	141,888	14.5	12.9	2.3	0.9	12.3	1.8	6.6	45.5
Intel	**INTC.OQ**	**O**	**USD**	**60.00**	**75.00**	**254,040**	**12.7**	**12.0**	**9.2**	**(7.2)**	**6.1**	**2.2**	**2.6**	**20.6**
Micron	**MU.OQ**	**O**	**USD**	**49.47**	**90.00**	**54,961**	**19.1**	**9.9**	**(47.7)**	**(58.0)**	**92.7**	**0.0**	**1.5**	**7.7**
NVIDIA	**NVDA.OQ**	**O**	**USD**	**408.06**	**425.00**	**250,957**	**70.4**	**49.5**	**(11.5)**	**(14.2)**	**42.3**	**0.0**	**15.8**	**22.5**
Xilinx	**XLNX.OQ**	**O**	**USD**	**100.49**	**100.00**	**24,439**	**37.6**	**31.1**	**(5.2)**	**(19.1)**	**20.6**	**0.0**	**8.5**	**22.8**
Datacenter and cloud operators														
21Vianet	VNET.OQ	O	USD	24.11	25.00	2,723	(147.4)	(131.2)	10.0	29.4	(12.4)	0.0	3.6	(2.5)
Alibaba	**BABA**	**O**	**USD**	**247.14**	**309.00**	**668,430**	**28.2**	**23.1**	**37.9**	**15.5**	**22.2**	**0.0**	**5.0**	**17.8**
Digital Realty	**DLR.N**	**O**	**USD**	**143.75**	**164.00**	**38,570**	**83.9**	**63.8**	**94.6**	**(27.2)**	**31.6**	**3.1**	**2.5**	**10.5**
Equinix	EQIX.OQ	O	USD	724.23	704.00	64,105	30.1	28.1	10.3	5.3	7.0	1.5	4.9	15.4
GDS	**GDS.OQ**	**O**	**USD**	**81.08**	**90.00**	**12,958**	**(1794.7)**	**1093.4**	**(4.4)**	**91.3**	**- to +**	**0.0**	**5.9**	**(0.3)**
Keppel DC REIT	KEPE.SI	O	SGD	2.61	2.91	3,124	26.5	25.6	5.5	10.8	3.6	3.4	2.2	8.0
Kingsoft Cloud	**KC.OQ**	**O**	**USD**	35.73	50.30	7,334	(56.3)	(71.5)	44.1	73.9	21.2	0.0	8.2	(14.6)
Switch, Inc.	SWCH.N	O	USD	17.95	23.00	4,337	121.0	64.1	11.0	15.1	88.7	0.0	6.1	5.0

Note: Names in bold are our preferred ideas currently. Priced as of 17 July 2020. O = Outperform, N = Neutral, U = Underperform.

Source: Company data, Credit Suisse estimates

The case for 'data'

We have been arguing since 2010 that the only demand curve investors should be levered to in all of tech is data—it is the demand segment that we are likely underestimating. We have broken data into four separate segments: (1) Data Creation/ Collection, (2) Data Storage, (3) Data Transmission and (4) Data Analytics. While it is clear that Data Analytics is the most important segment as it provides the mechanism to monetise data without which there is no sustainable business model, we have also argued that our paradigm represents a virtuous cycle—the more data one can monetise through analytics, the more valuable data becomes. The more valuable data becomes, the more one wants to create, which leads to more storage and transition/networking demand.

John Pitzer
+1 212 538 4610

Declining cost curves are powerful economic engines

While our Data Paradigm is now well understood and is mostly consensus within the investment community, we believe there is an important and under-appreciated dynamic also at play. The first three segments of data—Data Creation, Data Storage and Data Transmission—have all benefited from the non-linear COST declines during the digital age. Moore's Law states that every year it is cheaper to make a transistor; there is a Moore's Law equivalent in Storage and Networking called Kyrder's Law and Butter's Law, and Kryder's Law, respectively. Importantly, it has been our observation that as the cost per function has declined over time, the ecosystem has always exploited declining cost curves to develop new use cases; the elasticity of new applications has always grown the market to be significantly larger than anyone predicted at inception. In contrast, over time the cost of analytics has mostly only increased—until recently in order to analyse data it needed to be clean and structured, and unfortunately, most of the data that is created is messy and unstructured. To date, structuring the unstructured data has been prohibitively costly (Big Data/Fast Data promised to address this issue but did not) and as a result, the VAST majority of the data we create is dark and unanalysed (we currently analyse less than 2% of the data we create).

Declining cost curves create elasticity for new applications

AI is the Moore's Law of Analytics

It is in this light that Artificial Intelligence (AI) is an extremely important advancement as we see it as the first technology in the digital age that promises to systematically lower the cost of analytics—as AI bypasses the need to structure data in order to analyse it. While we are not willing yet to say that AI represents a predictable, durable non-linear reduction in the cost of analytics (albeit it is interesting to note that current AI progress has been tracking a Moore' Law curve every 6-9 months), we are growing more confident that AI is lowering the cost of analytics and opening up the available pool of data to be analysed. We are willing to take the leap of faith that as costs of analytics decline the ecosystem is poised to accelerate new use cases, growing the market to be likely significantly larger than even the most optimistic expectation.

AI important in lowering the cost of analytics to create new use cases

Quantifying the Semi TAM for data

AI significantly lowers the dependence of silicon on software—as AI is a silicon-based technology that utilises every incremental transistor it is given. Thus, as we transition from mostly creating data to actually analysing data, compute intensity is poised to accelerate. We expect this elasticity of application explosion to underpin our view that the US$90 bn Compute TAM CAGR will accelerate from its historic 3-5% to 10-15%. Additionally, in an attempt to define the AI TAM, which primarily reflects a desire for increased efficiency, we used total global spend on COGS, opex, capex—which exceeds US$43 tn/year. Just a 1% value capture by Semis as we transition to a Data-Driven Economy equates to ~US$400 bn incremental SAM against CY19 Global Semi Rev of US$409 bn, with compute likely to capture 20%+.

Semiconductor TAM for compute is US$90 bn and may see an accelerating TAM from 3-5% to 10-15%

Cloud/data-centre supply chain

Figure 10: Tech supply chain exposure to network infrastructure and servers

Name	Ticker	Analyst	Sector	Networking / Infrastructure	Servers	Total Cloud Related	PCs	Smartphone	TV	Consumer	Automotive	Others/ Industrial
Amkor	AMKR US	Randy Abrams	Backend	10%	0%	10%	5%	40%	5%	5%	25%	10%
ASE Industrial	3711 TT	Randy Abrams	Backend	10%	0%	10%	10%	45%	3%	12%	7%	13%
Chunghwa Precision	6510 TT	Randy Abrams	Backend	10%	0%	10%	10%	75%	1%	2%	0%	2%
Huatian	002185 CH	Chaolien Tseng	Backend	11%	0%	11%	1%	10%	12%	10%	56%	0%
Inari Amertron	INRI MK	Danny Chan	Backend	15%	0%	15%	3%	50%	0%	10%	2%	20%
Powertech Technology	6239 TT	Randy Abrams	Backend	0%	10%	10%	25%	30%	5%	20%	0%	10%
TongFu Microelectronics	002156 CH	Chaolien Tseng	Backend	0%	50%	50%	50%	9%	0%	15%	0%	26%
BizLink Holding	3665 TT	Pauline Chen	Component	3%	3%	5%	45%	0%	0%	25%	20%	5%
Chicony	2385 TT	Pauline Chen	Component	3%	3%	5%	48%	0%	0%	48%	0%	0%
Delta Electronics	2308 TT	Pauline Chen	Component	16%	5%	21%	26%	11%	0%	7%	10%	25%
DNF	092070 KS	Sang Uk Kim	Component	0%	4%	4%	66%	20%	0%	0%	0%	10%
FIT Hon Teng	6088 HK	Kyna Wong	Component	11%	9%	20%	18%	43%	0%	5%	2%	12%
Han's Laser Technology	002008 CH	Kyna Wong	Component	12%	0%	12%	10%	35%	10%	11%	17%	5%
IBIDEN	4062 JP	Akinori Kanemoto	Component	0%	20%	20%	n/a	n/a	n/a	n/a	n/a	n/a
LG Innotek	011070 KS	Sang Uk Kim	Component	5%	3%	8%	5%	67%	3%	0%	12%	5%
Lite-On Technology	2301 TT	Pauline Chen	Component	8%	5%	13%	53%	13%	0%	13%	8%	3%
Luxshare	002475 CH	Kyna Wong	Component	6%	2%	8%	10%	45%	0%	30%	5%	2%
Murata Manufacturing	6981 JP	Akinori Kanemoto	Component	5%	3%	8%	n/a	n/a	n/a	n/a	n/a	n/a
Partron	091700 KS	Sang Uk Kim	Component	5%	0%	5%	0%	85%	0%	0%	5%	5%
Samsung SDI	006400 KS	Sang Uk Kim	Component	12%	0%	12%	5%	20%	10%	3%	35%	15%
Sanan Optoelectronics	600703 CH	Kyna Wong	Component	5%	0%	5%	8%	12%	13%	12%	0%	50%
SEMCO	009150 KS	Sang Uk Kim	Component	17%	3%	20%	5%	40%	5%	5%	10%	15%
Shengyi Technology	600183 CH	Kyna Wong	Component	30%	10%	40%	5%	5%	5%	10%	25%	10%
Shennan Circuits	002916 CH	Kyna Wong	Component	65%	6%	71%	0%	10%	3%	0%	4%	12%
Shinko Electric Industries	6967 JP	Akinori Kanemoto	Component	0%	25%	25%	n/a	n/a	n/a	n/a	n/a	n/a
Sunway Communication	300136 CH	Kyna Wong	Component	5%	0%	5%	0%	80%	0%	6%	6%	3%
Taiyo Yuden	6976 JP	Akinori Kanemoto	Component	5%	3%	8%	n/a	n/a	n/a	n/a	n/a	n/a
Tongda	698 HK	Chaolien Tseng	Component	8%	0%	8%	1%	74%	0%	16%	0%	0%
TXC	3042 TT	Pauline Chen	Component	30%	3%	33%	18%	28%	0%	10%	5%	8%
Zhejiang Dahua	002236 CH	Kyna Wong	Component	5%	8%	13%	0%	0%	0%	20%	0%	67%
Hikvision	002415 CH	Kyna Wong	Components	5%	10%	15%	0%	0%	0%	20%	0%	65%
Nitto Denko	6988 JP	Mika Nishimura	Components	0%	5%	5%	30%	13%	0%	20%	32%	0%
Samsung Elec	005930 KS	Keon Han	Conglomerate	2%	9%	11%	5%	55%	10%	5%	4%	10%
Anritsu	6754 JP	Hideyuki Maekawa	Equipment	70%	0%	70%	n/a	n/a	n/a	n/a	n/a	n/a
Applied Materials	AMAT	John Pitzer	Equipment	2%	25%	27%	8%	35%	0%	23%	2%	5%
ASM Pacific Technology	522 HK	Kyna Wong	Equipment	5%	1%	6%	3%	19%	4%	5%	12%	51%
Brooks Automation	BRKS	John Pitzer	Equipment	0%	6%	6%	3%	23%	0%	17%	0%	51%
Fujitsu	6702 JP	Hideyuki Maekawa	Equipment	5-10%	0%	5-10%	12%	1%	n/a	n/a	n/a	n/a
Keysight Technologies	KEYS	John Pitzer	Equipment	63%	0%	63%	0%	16%	0%	2%	6%	13%
KLA Corporation	KLAC	John Pitzer	Equipment	4%	13%	17%	29%	27%	0%	17%	0%	10%
Lam Research Corp.	LRCX	John Pitzer	Equipment	1%	20%	20%	29%	28%	0%	19%	3%	1%
NEC	6701 JP	Hideyuki Maekawa	Equipment	17%	5%	22%	n/a	n/a	n/a	n/a	n/a	n/a
Renesas Electronics	6723 JP	Hideyuki Maekawa	Equipment	12%	0%	12%	n/a	n/a	n/a	n/a	n/a	n/a
SUMCO	3436 JP	Yoshiyasu Takemura	Equipment	0%	5%	5%	10%	30%	n/a	5%	8%	9%
Teradyne	TER	John Pitzer	Equipment	69%	0%	69%	2%	9%	0%	4%	3%	13%
Tokyo Ohka Kogyo	4186 JP	Yoshiyasu Takemura	Equipment	0%	5%	5%	10%	30%	n/a	5%	8%	9%
ZTE Corporation	000063 CH	Kyna Wong	Equipment	75%	5%	80%	0%	8%	0%	8%	0%	4%
ZTE Corporation	763 HK	Kyna Wong	Equipment	75%	5%	80%	0%	8%	0%	8%	0%	4%
AMD	AMD	John Pitzer	Fabless	0%	15%	15%	60%	0%	0%	20%	0%	5%
Analog Devices	ADI	John Pitzer	Fabless	18%	0%	18%	1%	10%	0%	6%	18%	47%
Aspeed	5274 TT	Randy Abrams	Fabless	5%	90%	95%	0%	0%	1%	4%	0%	0%
eMemory	3529 TT	Haas Liu	Fabless	5%	0%	5%	8%	65%	5%	10%	0%	7%
Marvell	MRVL	John Pitzer	Fabless	28%	0%	28%	53%	15%	0%	4%	0%	0%
MediaTek Inc.	2454 TT	Randy Abrams	Fabless	10%	0%	10%	5%	50%	10%	20%	0%	5%
Nvidia	NVDA	John Pitzer	Fabless	0%	25%	25%	47%	0%	0%	13%	6%	10%
Parade Technologies	4966 TT	Jerry Su	Fabless	3%	3%	6%	65%	2%	5%	2%	0%	20%
Realtek Semiconductor	2379 TT	Randy Abrams	Fabless	15%	0%	15%	35%	5%	15%	23%	1%	6%
Xilinx	XLNX	John Pitzer	Fabless	45%	2%	47%	6%	0%	0%	6%	9%	32%
Broadcom	AVGO	John Pitzer	Fabless	49%	0%	49%	1%	27%	0%	18%	1%	4%
Hua Hong	1347 HK	Randy Abrams	Foundry	8%	0%	8%	8%	10%	5%	35%	5%	30%
SMIC	981 HK	Randy Abrams	Foundry	5%	0%	5%	5%	45%	10%	25%	5%	5%
TSMC	2330 TT	Randy Abrams	Foundry	10%	5%	15%	20%	45%	2%	5%	5%	8%
United Microelectronics	2303 TT	Randy Abrams	Foundry	5%	1%	6%	13%	40%	13%	15%	5%	8%
VPEC	2455 TT	Jerry Su	Foundry	15%	0%	15%	5%	80%	0%	0%	0%	0%
Win Semiconductors	3105 TT	Jerry Su	Foundry	25%	0%	25%	0%	70%	0%	0%	0%	5%
Intel	INTC	John Pitzer	IDM	6%	30%	36%	50%	3%	0%	0%	1%	10%
Maxim	MXIM	John Pitzer	IDM	21%	0%	21%	4%	10%	0%	16%	21%	28%
NXP Semiconductors	NXPI	John Pitzer	IDM	21%	0%	21%	0%	13%	0%	0%	47%	18%
On Semi	ON	John Pitzer	IDM	5%	0%	5%	12%	14%	0%	14%	33%	22%
Pegatron	4938 TT	Pauline Chen	IDM	8%	0%	8%	12%	60%	1%	10%	3%	7%
Texas Instruments	TXN	John Pitzer	IDM	18%	0%	18%	3%	9%	0%	16%	19%	35%
Micron	MU	John Pitzer	Memory	11%	0%	11%	61%	11%	0%	10%	4%	3%
SK Hynix Inc.	000660 KS	Keon Han	Memory	2%	30%	32%	15%	30%	5%	5%	3%	10%
Advantech .	2395 TT	Pauline Chen	OEM/ ODM/ Brands	13%	0%	13%	8%	0%	0%	0%	0%	80%
Hon Hai Precision	2317 TT	Pauline Chen	OEM/ ODM/ Brands	13%	13%	25%	10%	49%	1%	13%	0%	3%
Inventec Co Ltd	2356 TT	Jerry Su	OEM/ ODM/ Brands	0%	38%	38%	43%	17%	0%	2%	0%	0%
Lenovo Group Ltd	992 HK	Jerry Su	OEM/ ODM/ Brands	0%	13%	13%	72%	13%	0%	0%	0%	2%
Quanta Computer	2382 TT	Jerry Su	OEM/ ODM/ Brands	0%	25%	25%	58%	0%	0%	13%	0%	4%
Sharp	6753 JP	Mika Nishimura	OEM/ ODM/ Brands	1%	8%	9%	40%	10%	15%	4%	22%	0%
Venture Corporation	VMS SP	Gerald Wong	OEM/ ODM/ Brands	15%	0%	15%	7%	0%	0%	0%	0%	78%
Wistron	3231 TT	Jerry Su	OEM/ ODM/ Brands	0%	28%	28%	42%	22%	3%	0%	0%	5%
Gigabyte Technology	2376 TT	Jerry Su	PCB/ Substrates	0%	23%	23%	77%	0%	0%	0%	0%	0%
Kinsus Interconnect	3189 TT	Pauline Chen	PCB/ Substrates	20%	0%	20%	13%	43%	0%	18%	0%	8%
Nan Ya PCB	8046 TT	Pauline Chen	PCB/ Substrates	45%	0%	45%	15%	10%	0%	13%	15%	3%
Topoint Technology	8021 TT	Pauline Chen	PCB/ Substrates	3%	0%	3%	16%	40%	0%	39%	3%	0%
Tripod Technology	3044 TT	Pauline Chen	PCB/ Substrates	3%	13%	15%	15%	20%	15%	10%	20%	5%
Unimicron Technology	3037 TT	Pauline Chen	PCB/ Substrates	5%	3%	8%	28%	30%	0%	18%	15%	3%

Source: Company data, Credit Suisse estimates

Table of Contents

Focus charts and tables 2

Cloud computing: The next frontier 3

- Increasing workload shift to the cloud 3
- Cloud is driving growth for hyperscalers 3
- Rise of the ODM model and merchant silicon 3
- Supply chain opportunities 3

Key stock picks 4

The case for 'data' 5

Cloud/data-centre supply chain 6

Increasing workload shift to the cloud 10

- Cloud Enabler 1: Increasing connected devices adoption driving accelerating data consumption 11
- Cloud Enabler 2: Proliferation of services on the cloud for business transformation 16
- Cloud Enabler 3: Accelerating AI Data Analytics 19

Cloud is driving growth for hyperscalers 22

- Enterprise server/storage to grow faster than IT infrastructure 22
- CS forecasts robust public cloud server growth 23
- Types of data centres 26
- Hyperscalers growing much faster than overall servers 28
- Switch market growth mild, but whitebox rising 31
- Data-centre switching outpacing enterprise switching 32
- Healthy cloud momentum despite COVID-19 35
- Surge in activity supports 2Q20-3Q20, 4Q20/1Q21 could pause ahead of Ice Lake .. 35

Rise of the ODM model and merchant silicon 39

- Open Compute Project (OCP): A major turning point 39
- ODM Direct key beneficiaries from the OCP rollout 41
- Networking switch ODM Direct grows from a low base 43
- New opportunities from 5G proliferation 44
- Cloud IT infrastructure ODMs: Competitive landscape 49
- Rise of Merchant Silicon: Broadcom and Marvell 54
- Sector investment risks 57

Supply chain opportunities 59

Sector Section 64

Asian Hardware: PCs and ODMs 65

Asian Hardware: Components 68

Asian Hardware: China Downstream 69

Asian Semiconductors: Foundry/Backend/IC Design 73

Asian Semiconductor: IC Design Services 77

Global Semiconductors: Memory 80

Japan technology sector 87

China data centre operators 88

China cloud operators 90

Stock Section 93

Accton 94

Advanced Micro Devices, Inc. 96

Alchip Tech 98

Aspeed 100

Broadcom Ltd 102

Dell Technologies 104

Delta Electronics 106

Digital Realty Trust, Inc. 108

Equinix, Inc. 110

Foxconn Industrial Internet 112

GDS Holdings Limited 114

GUC 116

Hewlett Packard Enterprise 118

Intel Corp. 120

International Business Machines 122

Inventec Co Ltd 124

Keppel DC REIT 126

Lenovo Group Ltd 128

Micron Technology Inc. 130

MiTAC Holdings Corporation 132

NetApp 134

NVIDIA Corporation 136

Parade Technologies 138

Quanta Computer 140

Samsung Electronics 142

Shengyi Technology 144

SK Hynix Inc. 146

Switch, Inc. 148

Taiwan Semiconductor Manufacturing 150

TongFu 152

Wiwynn Corporation 154

Xilinx 156

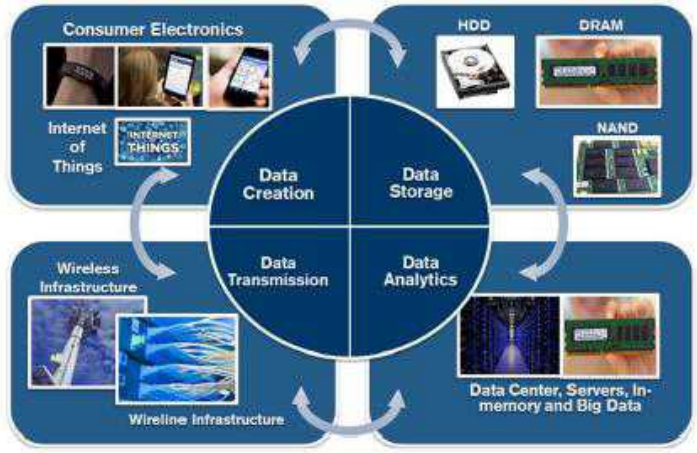
21Vianet Group 158

Increasing workload shift to the cloud

We believe the global cloud IT infrastructure markets will ride on the favourable industry trend from an increasing traffic shift to cloud data centres, as IDC forecasts total spending on cloud IT infrastructure will grow at a 10% CAGR from US$67 bn in 2019 to US$88 bn by 2022. Data growth has four components: (1) Data Creation, (2) Data Storage, (3) Data Transmission and (4) Data Analytics. Data Analytics is the most important, as it provides the economic engine (i.e., as Data Analytics becomes more pervasive, data inherently becomes more valuable), which, in turn, should drive demand for more data. More Data Creation drives more Data Storage and Transmission and ultimately more Data Analytics, making a virtuous cycle).

Declining cost curves create elasticity for new applications
IDC forecasts cloud infrastructure spending will grow at a 10% CAGR through 2022

Figure 11: Data growth—self-perpetuating dynamic

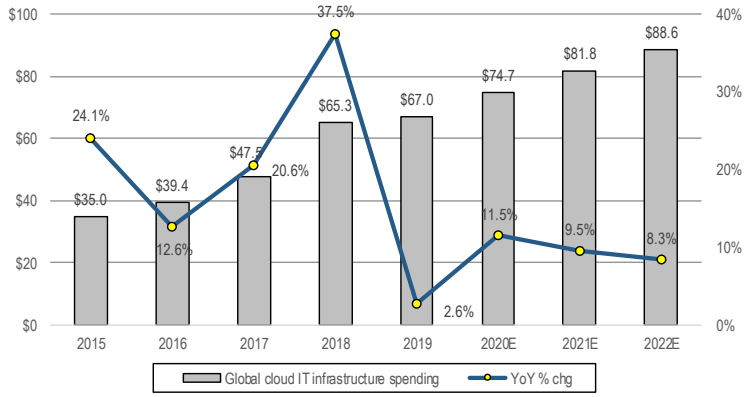


Source: Credit Suisse

We believe the global cloud IT infrastructure markets will continue to ride on the favourable industry trend of the increasing workload shift to the cloud, while COVID-19 has further accelerated the process, accommodating the accelerating cloud demand from 'everything-from-home' (work-from-home, play-from-home, study-from-home) amidst the virus concerns globally. Evidently, Cisco's 2019 Visual Networking Index (VNI) report estimates global IP traffic will grow at a 25.6% CAGR from 2019 to 2022 to 396 Exabytes (EB) per month or 4.8 Zettabyte (ZB) per year almost doubling from the 2019 level (i.e. 200 EB/month or 2.4 ZB/year).

IP growth is maintaining a 26% growth CAGR

Figure 12: Global cloud IT infrastructure markets forecasted to deliver a 10% CAGR from 2019-22, reaching US$88.6 bn in total size
Cloud IT infrastructure spending in USD bn (L-axis) and YoY % change (R-axis)

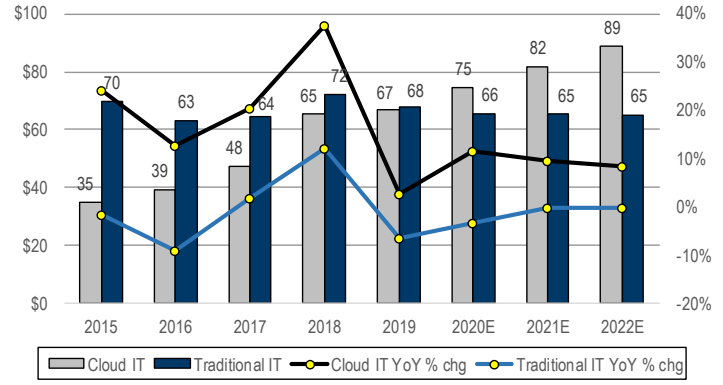


Source: Company data, IDC, Credit Suisse

Overall, according to IDC, global IT infrastructure spending (including cloud and traditional IT infrastructure) reached US$134.7 bn in 2019, implying a 6.5% CAGR from 2015. IDC expects cloud IT infrastructure spending to represent half of the total spending for the first time in 2019, and forecasts cloud IT-mix will grow further to represent nearly 60% of the total spending by 2022, implying a 10% CAGR over 2019-22, while traditional IT infrastructure spending will decline at a 1.2% CAGR for the same period.

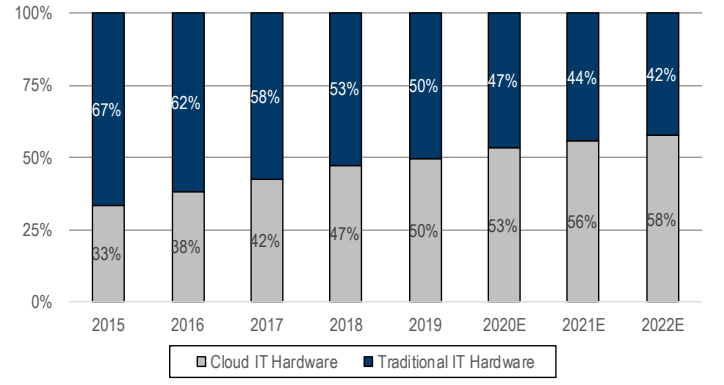
IT infrastructure spending is expected to grow at 6.5% overall from 2019-22, but cloud is growing at a 10% rate and traditional IT at -1%

Figure 13: Global cloud IT infrastructure hardware spending forecasted to see a 10% CAGR growth over 2019-22, vs traditional IT's 1% CAGR decline for the same period
Sales in US$ bn (L-axis) and YoY % change (R-axis)



Source: Company data, IDC, Credit Suisse

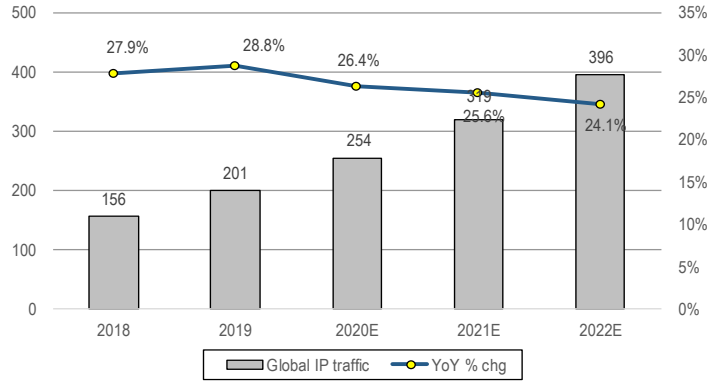
Figure 14: Global cloud IT infrastructure spending reaching 50% of the total mix for the first time in 2019, and to grow to closer to 60% by 2022
% of total sales



Source: Company data, IDC, Credit Suisse

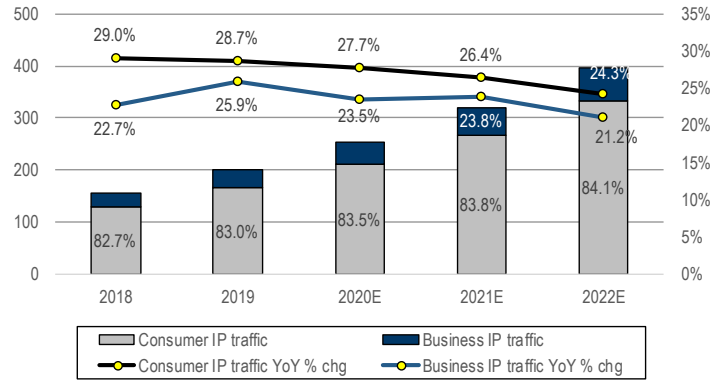
By segment, Cisco expects consumer IP traffic to grow at a faster 26.1% CAGR from 2019-22, representing the majority of the total IP traffic (i.e. 83-84%), while business IP traffic makes up for the rest and is still delivering a 22.8% CAGR for the same period. Lastly, it expects Asia Pacific to post the fastest internet traffic growth at a 29% CAGR for 44% of the total traffic by 2022 (vs 40% in 2019), while North America and Europe will grow roughly in line with the overall markets for 40% of the total data flows, vs 45% in 2019.

Figure 15: Global IP traffic projected to see a 26% CAGR growth from 2019 to 2022
IP traffic in EB/month (L-axis) and YoY % change (R-axis)



Source: Company data, Cisco, Credit Suisse

Figure 16: Consumer IP traffic growing at a faster speed vs business, driving 83-84% of the global IP traffic
IP traffic in EB/month (L-axis) and YoY % change (R-axis)



Source: Company data, Cisco, Credit Suisse

Cloud Enabler 1: Increasing connected devices adoption driving accelerating data consumption

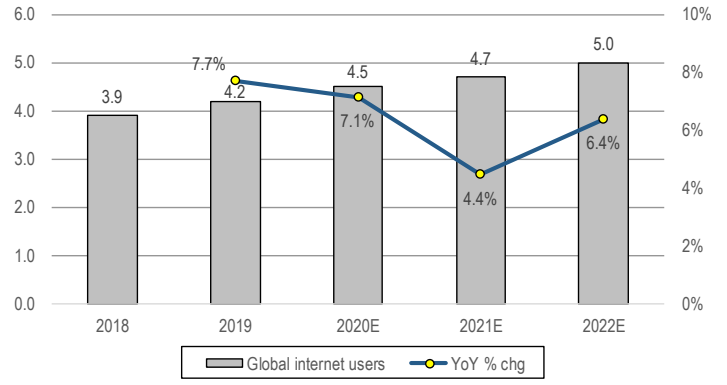
We believe the growing connected devices and machine-to-machine (M2M) adoption empowered by the latest connectivity standards such as 5G and Wi-Fi 6, as well as LPWAN (LoRaWAN) and NB-IoT to connect IoT devices, will lead to an increase in data consumption,

Global devices and connections are projected to grow at a 10% CAGR from 2019-22

driving hiking demand needs for cloud and edge IT infrastructure investment. Cisco pointed out in its 2020 Annual Internet Report that it estimates global internet users to reach 5 bn by 2022, up from 4.2 bn in 2019 for a 6% growth CAGR, representing over 60% of the global population. It expects global devices and connections to grow even faster than the internet user growth at nearly a 10% CAGR from 2019-22, driven by the accelerating growth in the average numbers of devices per capita and household.

Figure 17: Global internet users to grow at a 6% CAGR for a total of 5 bn by 2022 from 2019

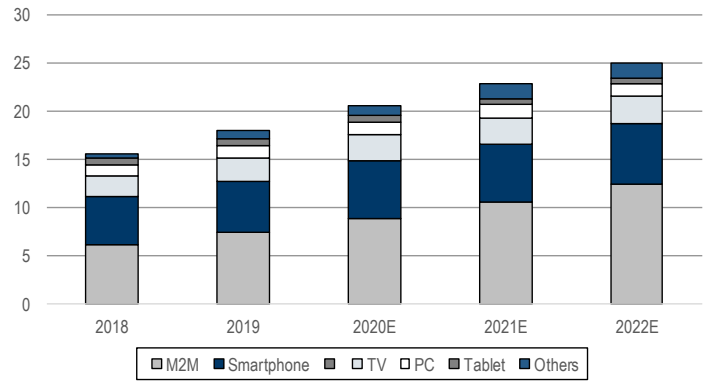
Global internet users in billions (L-axis) and YoY % change (R-axis)



Source: Company data, Cisco, Credit Suisse

Figure 18: M2M connectivity leads all categories, while the combined shares for various CEs decline

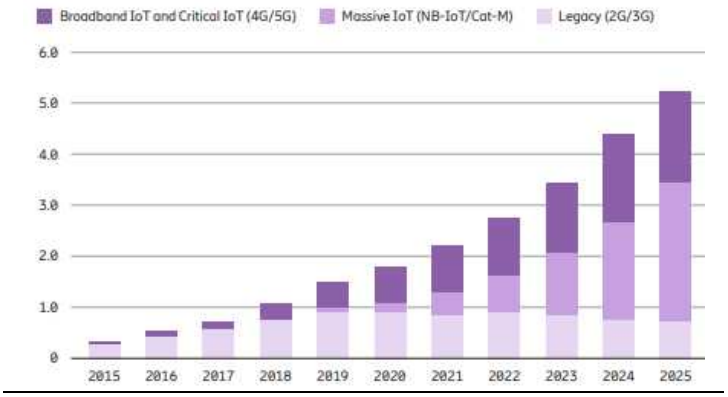
Billions of connected devices



Source: Company data, Cisco, Credit Suisse

Among all, M2M connections (i.e. smart home, healthcare monitoring, smart transportation, smart manufacturing, etc.) are expected to deliver the highest growth with a 19% CAGR from 2019-22, representing 13 bn or 46% of the 25 bn total connected devices in 2022, vs 36% in 2019, supported by the increasing use-cases scenario, and new video-facilitated instances such as smart car with increasing needs of M2M connectivity. Of those devices, cellular connected IoT devices are projected to grow 3x from 2020-25 to 5 bn units. These devices will consist of 1 bn units on legacy 2G/3G networks, 2.5 bn units on NB-IoT or Cat-M low speed networks, and 1.5 bn requiring broadband connections on 4G and 5G networks.

Figure 19: Cellular IoT connections to grow 3x to 5.5 bn by 2025



Source: Ericsson Mobility Report, June 2020

Figure 20: Traffic rising from more devices at faster speeds

Source: Cisco

In comparison, Cisco expects the relative shares for consumer electronics including smartphones, PCs/tablets, TVs, and others, to deliver a 2% CAGR for the same period, but its relative shares to decline to 54% in 2022, vs 64% in 2019, despite the continued growth of mobile subscribers (i.e. +8% CAGR for 5.6 bn in 2022, vs 5.2 bn in 2019), offset by the more saturated penetration of traditional consumer electronics devices.

Cellular IoT connections projected to grow 3x to 5.5 bn by 2025

The aggregate trend for data traffic is positive for 2018-23, spurred by three vectors: (1) mobile users growing by 12% to 5.7 bn units; (2) mobile connections rising 49% to 13.1 bn units; and (3) faster mobile speeds increasing from 13.2Mbps to 43.9Mbps.

The IoT connectivity will span a broadening set of applications for the home, office, auto, city, manufacturing, energy, medical, retail and other industry verticals (agriculture, construction and emergency services).

Figure 21: A number of connected applications driving data traffic increases

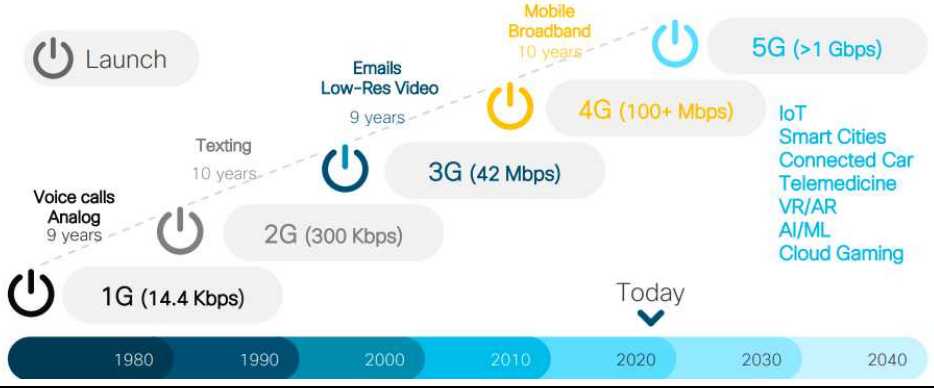
Connected Home
• Home automation
• Building security
• Network equipment – printers +
• Network infrastructure – routers +
• White goods
• Tracking applications
• Household information devices
Connected Work
• Office building automation
• Building security
• Office equipment – printers +
• Routers +
• Commercial appliances
Connected Car
• Fleet management
• In-vehicle entertainment systems, emergency calling, Internet
• Vehicle diagnostics, navigation
• Stolen vehicle recovery
• Lease, rental, insurance management
Connected Health
• Health monitors
• Assisted living – medicine dispensers +
• Clinical trials
• First responder connectivity
• Telemedicine
Connected Cities
• Environment and public safety – closed-circuit TV, street lighting, waste removal, information +
• Public space advertising
• Public transport
• Road traffic management
Retail
• Retail goods monitoring and payment
• Retail venue access and control
• Slot machines, vending machines
Manufacturing & Supply Chain
• Mining and extraction
• Manufacturing and processing
• Supply chain
• Warehousing and storage
Energy
• New energy sources – monitoring and power generation support apps
• Smart grid and distribution
• Micro-generation– generation of power, by residential, commercial and community users on their own property
Other
• Agriculture – livestock, soil monitoring, water and resource conservation, temperature control for milk tanks +
• Construction: Site and equipment monitoring
• Emergency services and national security

Source: Cisco VNI Global Mobile Data Traffic Forecast

5G transition to provide an additional impetus

The mobile evolution from 1G to 4G has improved speeds from 14.4kbps to 100+Mbps, with shifting traffic on these mobile networks—from voice calls, texting, email, low resolution video, to now social media and richer video with 4G devices. The 5G build-out should help improve data speeds and the number of varying devices handled on the network to more advanced connected services. 5G should bring out support for cloud gaming, machine learning, AR/VR, telemedicine, connected vehicles and smart city services.

Figure 22: 5G bandwidth supporting new-use cases

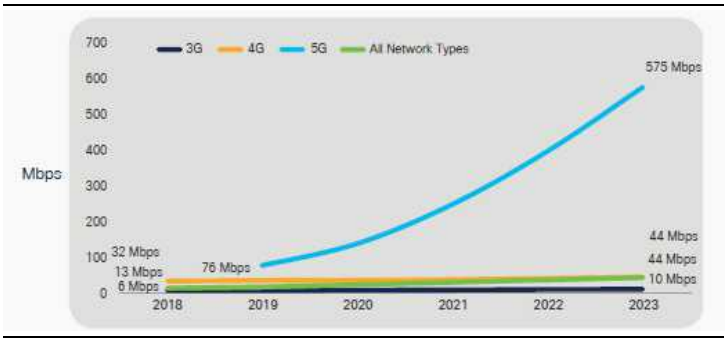


Source: Cisco VNI Global Mobile Data Traffic Forecast

According to Cisco, 5G true data rates experienced by the average user should also continue to improve, rising from the 76Mbps in 2019 to 575 Mbps by 2023, far eclipsing the 44Mbps on 4G and 10Mbps on 3G. At the same time, fixed broadband speeds, according to Cisco, would also improve at a 20% CAGR, with average global speeds improving from 61Mbps in 2020 to 110Mbps in 2023.

5G data rates projected to improve to 575Mbps versus 44Mbps for 4G data by 2023

Figure 23: 5G data rates to be over 10x 4G speeds



Source: Cisco Annual Internet Report, 2020

Figure 24: Fixed broadband speeds to deliver a 20% CAGR (Mbps)

Region	2018	2019	2020	2021	2022	2023	CAGR (2018–2023)
Global	45.9	52.9	61.2	77.4	97.8	110.4	20%
Asia Pacific	62.8	74.9	91.8	117.1	137.4	157.1	20%
Latin America	15.7	19.7	34.5	41.2	51.5	59.3	30%
North America	56.6	70.1	92.7	106.8	126.0	141.8	20%
Western Europe	45.6	53.2	72.3	87.4	105.6	123.0	22%
Central and Eastern Europe	35.0	37.2	57.0	65.5	77.8	87.7	20%
Middle East and Africa	9.7	11.7	25.0	29.0	34.9	41.2	33%

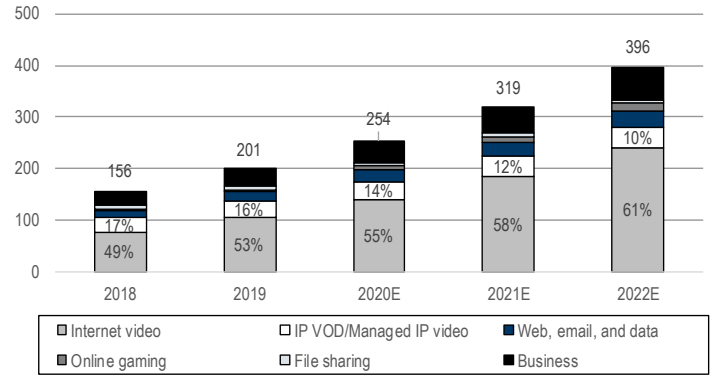
Source: Cisco Annual Internet Report, 2020

Video remains a key application

The rising speed is expected to enable better carrying of more advanced FHD and 4k video at lower latency. By data source, Cisco believes that consumer IP video (including internet video, IP video on demand, video files exchanged through file sharing, video-streamed gaming, etc.) would drive the majority of internet traffic, representing 71% of total data flow (or 82% of total including business applications such as video conferencing), vs 69% in 2019.

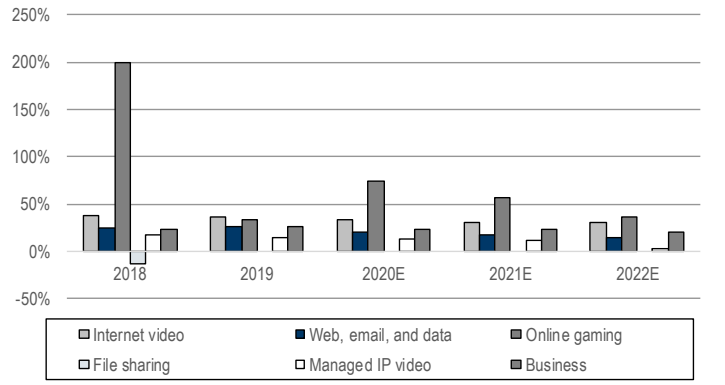
Cisco also expects online gaming to post the highest growth from a lower base at a 55% CAGR from 2019-22 and 4% of total traffic by 2022, vs 2% in 2019, especially with the introduction of gaming streaming platforms by Google (Stadia), NVIDIA (GeForce Now) and Microsoft (Project xCloud). Lastly, it expects file sharing, web, email, and others to contribute the remaining 10% of global IP internet traffic.

Figure 25: IP video continues to be the dominant driver, representing 70-80% of global IP traffic
IP traffic in EB/month and % of mix



Source: Company data, Cisco, Credit Suisse

Figure 26: Gaming growth is outperforming on a lower base with IP traffic to deliver a 55% CAGR and 4% of mix by 2022
YoY % change in IP traffic (EB/month)



Source: Company data, Cisco, Credit Suisse

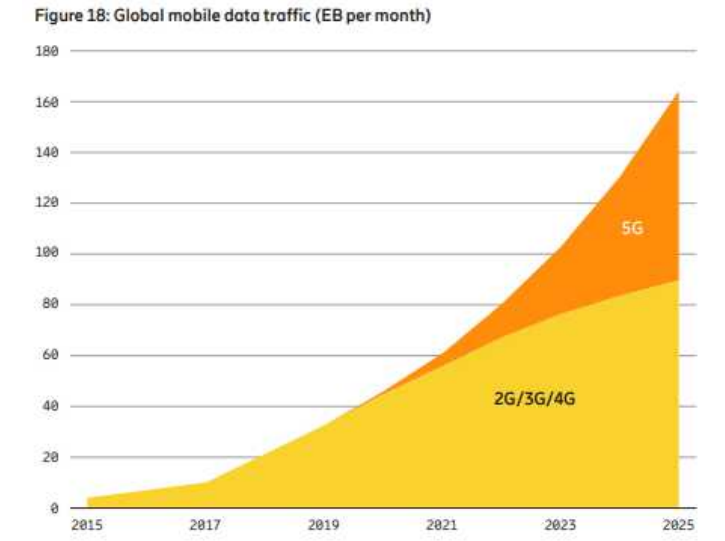
Overall, we believe the growing connected devices as well as average numbers of connected devices per capita or household should drive expanding internet traffic flow especially fuelled by the acceleration of data traffic from IP videos. According to Ericsson's Mobility Report, data growth carried by cellular has maintained 60-70% growth over the past five years and is projected to grow 3x with the launch of 5G to 160 exabytes carried on the network per month.

Ericsson is still noting 60-70% growth in mobile traffic each year

We believe this traffic growth would be increasingly supported by cloud IT infrastructure capacities owned by the hyperscalers. At the same time, we believe it should spur new business model creation from the Next Wave CSPs (cloud service providers) such as Uber, Netflix, Twitter, ByteDance etc. or newly emerging unicorns to capitalise on the unmet market opportunities from the hyperscalers. All in all, we believe Taiwan cloud IT infrastructure ODMs,

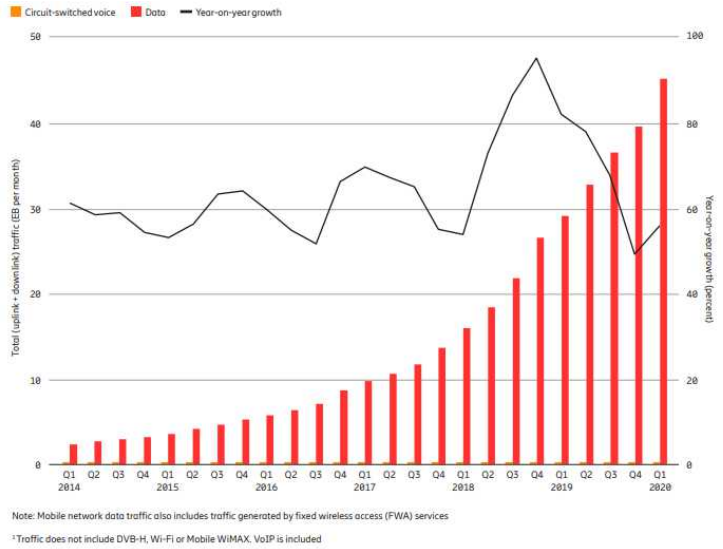
especially Quanta and Wiwynn, would be the key beneficiaries, given their expertise in cloud IT infrastructure, driving enhanced total cost of ownership (TCO) through better hardware customisation and tailoring for various use-case scenario by the CSPs.

Figure 27: Global mobile traffic to grow 3x from 2020-25
(EB/Month)



Source: Ericsson Mobility Report, June 2020

Figure 28: Mobile data traffic maintaining 60-70% growth
(EB/month)


Circuit-switched voice
Data
Year-on-year growth
Total (uplink + downlink) traffic (EB per month)
Year-on-year growth (percent)
Note: Mobile network data traffic also includes traffic generated by fixed wireless access (FWA) services
Traffic does not include DVB-H, Wi-Fi or Mobile WiMAX. VoIP is included

Source: Ericsson Mobility Report, June 2020

Edge computing to accelerate as a result of proliferating devices and 5G

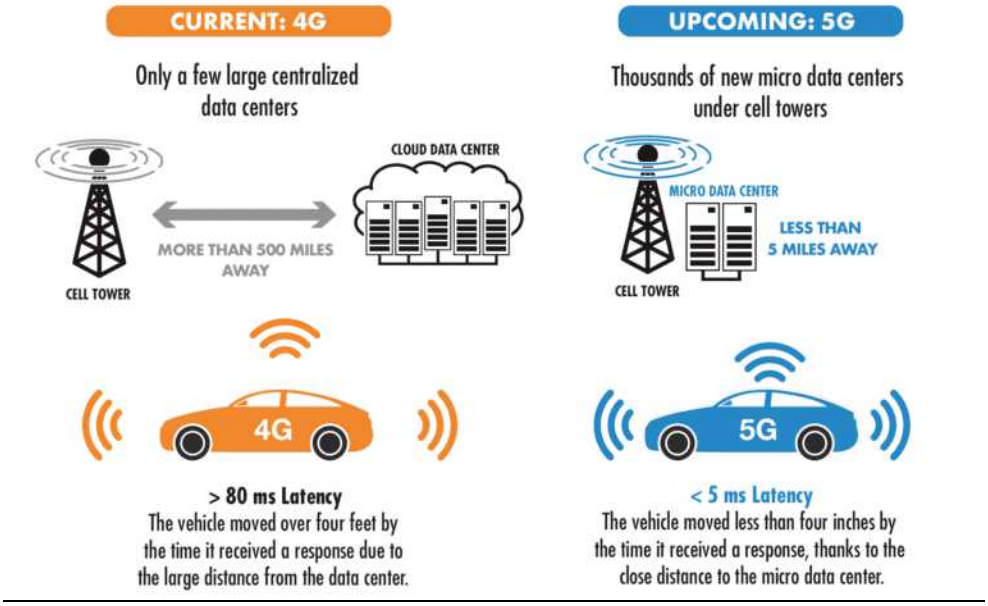
With the rising number of internet-connected and machine-to-machine (M2M) devices, there is an increasing amount of IP traffic. Today's internet networks cannot handle the high-speed data transmissions that tomorrow's connected devices require. In traditional IP architecture, data must often travel hundreds of miles over a network between end-users or devices and cloud resources. This results in latency, or the slow delivery of time-sensitive data (connectorsupplier.com). Latency has long been a problem in managing networks, but it has become more of a critical concern with the proliferation of data (and attendant data analytics), number of devices (Internet of Things), and rising use of cloud and streaming services. End-users and devices demand anywhere and anytime access to applications, services, and data housed in today's data centres.

The solution to reducing latency lies in edge computing. By establishing IT deployments for cloud-based services in edge data centres in localised areas, IT resources are effectively brought closer to end-users and devices. This helps to achieve efficient, high-speed delivery of applications and data. Edge data centres are typically located on the edge of a network, with connections back to a centralised cloud core.

Edge computing will not materialise independently: its development is driven by the next iteration of mobile telephony, 5G. Therefore, edge computing and 5G are mutually dependent and will co-evolve: 5G cannot deliver on its promises without ultra-low latency and high levels of interconnection, or in other words, without a large fleet of smaller data centres physically located within the populations they serve. Together, they should deliver faster data processing, local caching and sharing of compute-power, energy efficiency at both the network and device level, resilience and security, and optimal work allocation.

5G will help enable build-out of more edge data centres, another leg to hardware investment

Figure 29: The use case for edge computing—lowering latency

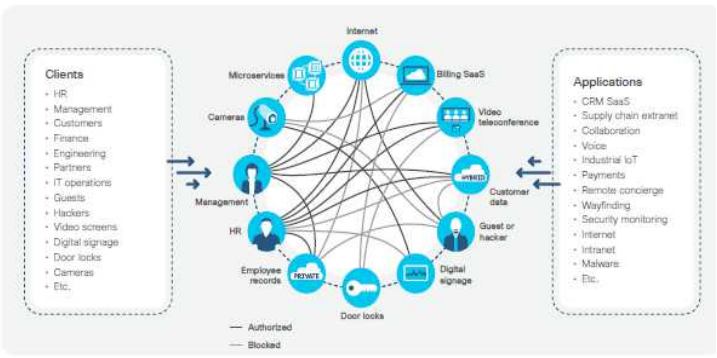

CURRENT: 4G
Only a few large centralized data centers
CLOUD DATA CENTER
MORE THAN 500 MILES AWAY
CELL TOWER
4G
> 80 ms Latency
The vehicle moved over four feet by the time it received a response due to the large distance from the data center.
UPCOMING: 5G
Thousands of new micro data centers under cell towers
MICRO DATA CENTER
LESS THAN 5 MILES AWAY
CELL TOWER
5G
< 5 ms Latency
The vehicle moved less than four inches by the time it received a response, thanks to the close distance to the micro data center.

Source: connectorsupplier.com

Cloud Enabler 2: Proliferation of services on the cloud for business transformation

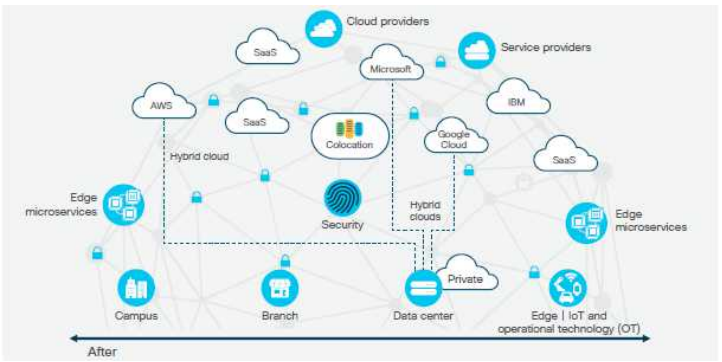
Aside from the increasing data workload as a result of the growing connected devices, especially M2M, and the acceleration of data traffic from IP videos, we believe the proliferation of services on the cloud is also one of the key enablers for the accelerating data consumption in businesses, leading to the growing need for cloud IT infrastructure. The corporate network is seeing a huge increase in network complexity as enterprise applications have moved to the cloud for CRM, supply chain, HR records, industrial IoT, payments and network security. The range of clients supported on the network is also rising including the various department applications and also a new network of connected devices including video, signage, door locks, cameras and personal connected devices.

Figure 30: Network complexity rises with more clients/apps



Source: Cisco Global Networking Trends Report, 2020

Figure 31: Networks moving to a distributed compute model



Source: Cisco Global Networking Trends Report, 2020

Corporates are moving to a distributed compute model which includes own enterprise campus, branch and data centre for mission critical applications along with connection to multiple clouds (AWS, Microsoft, Google, IBM). As manufacturing operations become connected, corporates should also manage more Edge/IoT devices on cloud networks.

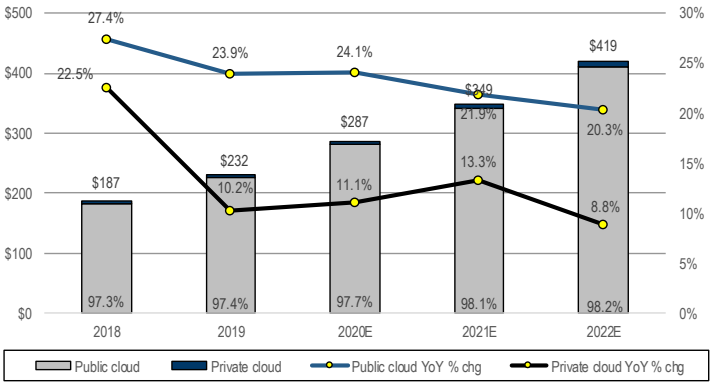
IDC notes that 56% of organisations own and retain unstructured data sets that are larger than 51 petabytes. Furthermore, 40% of these organisations expect annual data growth of 30-49%

over the next two years—notably led by state and federal governments. We also note that ~1/3 of government entities expect 70-89% of their data to be retained long term—further underscoring the opportunity for storage. IDC expects the amount of data created over the next three years to be larger than the total data created in the past 30 years.

Cloud service sales are projected to grow at a 22% CAGR to US$420 bn between 2019 and 2022

According to IDC, global cloud services sales are forecast to reach nearly US$420 bn by 2022, with a CAGR of 22% from 2019. In addition, it expects cloud services sales derived from public cloud to make up the majority of total sales (i.e. 97-98%) by growing roughly in line with the market over the same period, and private cloud service sales to deliver an 11% CAGR, reaching a total size of US$7.4 bn by 2022, vs US$5.4 bn in 2019.

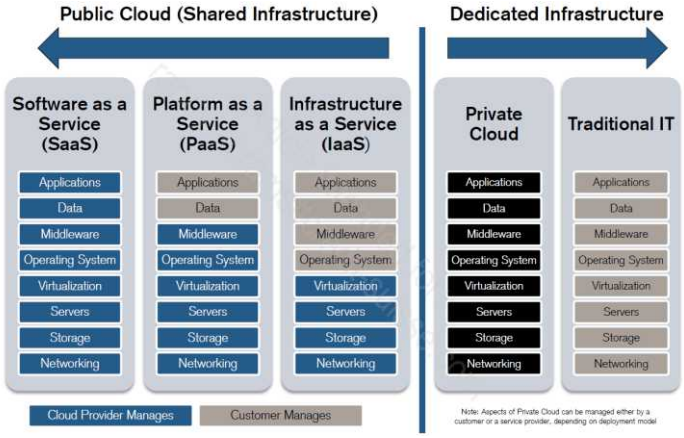
Figure 32: Global cloud services sales to reach US$419 bn by 2022, vs US$232 bn in 2019, or more than a 22% CAGR, and public cloud driving the majority of sales
Sales in US$ bn (L-axis) and YoY % change (R-axis)



Source: Company data, IDC, Credit Suisse

IDC expects the public cloud platform to continue to be extensively leveraged by enterprises across industries and firm sizes given lower initial capex outlay requirements on subscription-based models, and a variety of services available to drive management innovation on the leading public cloud platforms (i.e. Microsoft's Azure, Amazon's AWS, etc.).

Figure 33: Public cloud vs. private cloud vs. traditional IT



Source: IDC

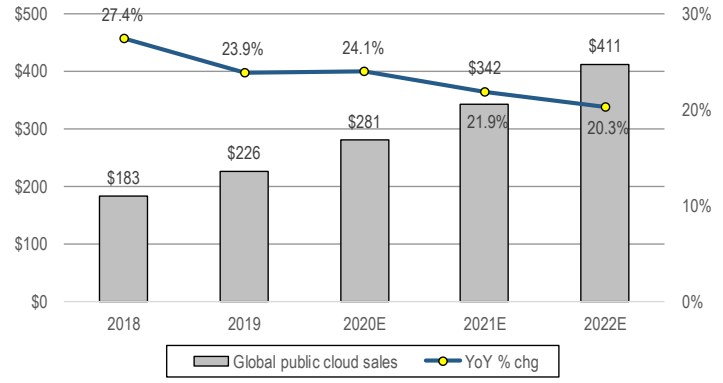
Infrastructure as a Service growing the fastest at a 31% CAGR

Among all the services provided by the public cloud companies, IDC notes that Software-as-a-Service (SaaS) should continue to dominate, representing 55% of total sales in 2022, but down from 63% in 2019, supported by key applications including customer relationship management (CRM), and enterprise resource management (ERM), as well as security SaaS for infrastructure software. In addition, it expects Platform-as-a-Service (PaaS) to be faster with nearly a 30% CAGR from 2019-22 (vs the market's +22% CAGR) driven majorly by fast-growing demand for cloud-based databases, analytics and AI, and integration and orchestration services. Lastly,

Infrastructure-as-a-Service (IaaS) is expected to deliver the fastest expansion with more than a 31% CAGR from 2019-22, as clients opt for greater compute and storage capacities to support the growth of PaaS and SaaS.

Figure 34: Global public cloud sales projected to deliver a 22% CAGR from 2019-22

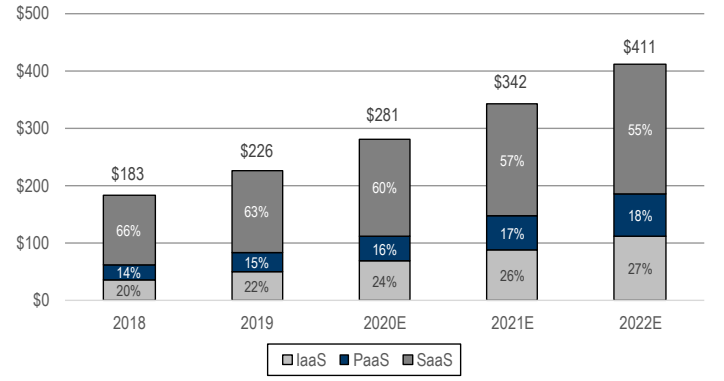
Sales in US$ bn (L-axis) and YoY % change (R-axis)



Source: Company data, IDC, Credit Suisse

Figure 35: IaaS growing fastest among all segments with over a 31% CAGR to support increasing SaaS/PaaS capacity needs

Sales in US$ bn and % of mix



Source: Company data, IDC, Credit Suisse

On the other hand, IDC believes private cloud services sales should maintain a positive growth trajectory, with a 7% CAGR from 2019-22, representing 1-3% of total cloud services sales, on the back of increasing adoption and/or shift away from public cloud to private or hybrid cloud. Specifically, IDC highlighted the offering of the next-generation hardware on more standardised software-defined infrastructure (SDI) for better scalability; the broader availability of turnkey solutions on open-sourced software stacks; and more flexible economic models, being key drivers for the growing proliferation of private cloud adoption.

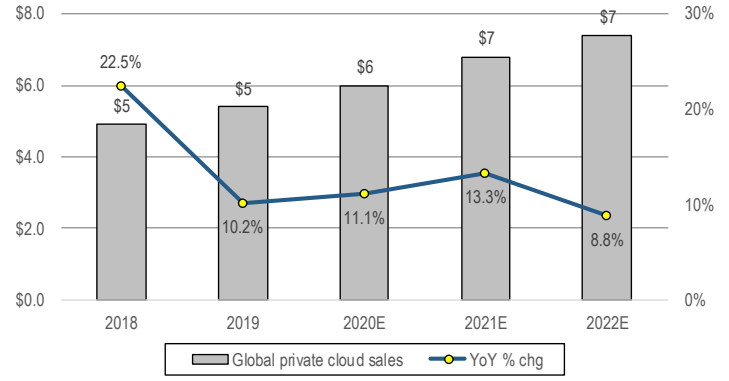
Figure 36: Public and hybrid cloud seeing wider adoption

	Public Cloud	Hybrid Cloud	Private Cloud	Traditional IT
What is it?	• Owned operated by cloud providers in a shared, multi-tenant model • Includes SaaS, PaaS, and IaaS	• Operating model that allows dynamic movement of apps and data across on-prem and off-prem IT • Consistency across on-prem and off-prem will be key	• Dedicated IT infrastructure for the benefit of a single customer • Can be owned/operated by customer or a third party	• Dedicated IT infrastructure owned and operated by an organization. • Typically managed in product and/or application silos
Pros	• Agility means faster time to production • Outsource management of layers of the IT "stack" • Pay as you go; metered billing • Highly scalable, on-demand	• Best of both worlds; place applications where makes most sense • Ability to "burst" to public cloud when needed • Cost arbitrage	• Dedicated infrastructure; more control • Brings more flexibility and agility vs. traditional IT • Removes silos • More easily scalable than traditional IT	• Dedicated infrastructure; more control • Easily integrate with legacy IT investments • Leverage best of breed across the IT "stack"
Cons	• Security • Getting "locked in" to a specific cloud provider • Pricing / cost not always cheaper • Data moves off-prem	• Early stage, offerings still maturing • May require significant integration work ahead of implementation • Talent shortage	• Often still requires capex outlays and management of equipment • May require significant integration work ahead of implementation • Talent shortage	• Operationally complex • Expensive • Inefficient; often leads to over-capacity • Long procurement cycles for new applications

Source: IDC, Gartner, NSIT, Credit Suisse

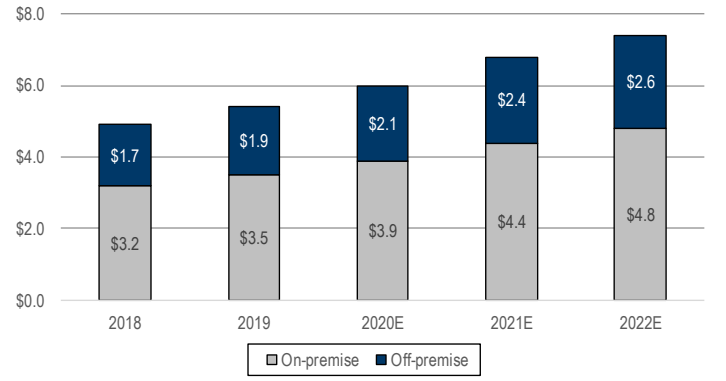
Overall, we expect a healthy balance between the public and private cloud environment, as corporates balance trade-off between concerns on security and the physical ownership of data, vs size of opex and capex, depending on corporate strategic planning. It may also make more sense economically for the larger corporates such as Fortune 500 enterprises to maintain physical infrastructure either on-premise or off-premise through host or co-location, in order to achieve better flexibility in resource management and optimisation.

Figure 37: Global private cloud services sales to deliver a 7% CAGR from 2019-22
Sales in US$ bn (L-axis) and YoY % change (R-axis)



Source: Company data, IDC, Credit Suisse

Figure 38: Both on-premise and off-premise services to grow roughly in line with the overall private cloud market
Sales in US$ bn



Source: Company data, IDC, Credit Suisse

Cloud Enabler 3: Accelerating AI Data Analytics

AI analytics offers potential for a new rising compute TAM

The new data economy rests heavily on AI's ability to analyse the data that is being created at the edge and in the cloud in its unstructured form. NVIDIA currently has significant share in HPC/AI applications, but other entrants are vying for share in the space (Intel and Xilinx with FPGAs, AMD with GPUs, and potentially others down the line). We believe a rising tide can lift all boats in AI. We continue to argue that investors and companies alike are underestimating the potential compute TAM as the industry is on the cusp of a strong inflection of compute demand that would be stimulated as AI fundamentally lowers the cost of analytics for the first time in history and leads to a massive wave of data analytics for new "killer applications".

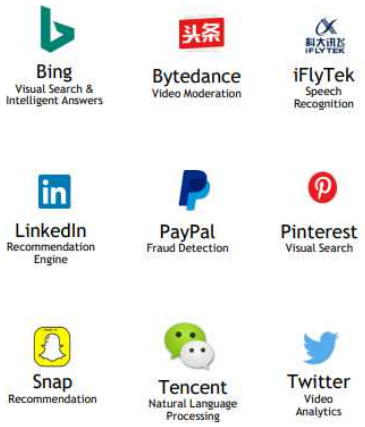
The semiconductor market for compute is US$90 bn and could grow to US$130 bn by 2025 (6% CAGR), with potential to accelerate to a 10-15% growth rate transitioning from creating data to analysing data

We estimate that the semi market for compute (CPU, GPU, FPGA, APU) to be ~US$90 bn growing to ~US$130 bn by 2025 (a 6% CAGR). Specifically, while the first three buckets of data have come from non-linear cost declines (Moore's, Butter's, Kryder's Law) these have in turn driven an explosion of application elasticity and TAM expansion significantly larger than expected at inception. To date, the cost of analytics has only increased: ~98% of data created is unstructured; analytics schemes to date need structured data; and cleaning-up/organising unstructured data is extremely costly. AI/ML represents the first technology which allows for unstructured data analytics—dramatically lowering analytic costs and likely leading to an explosion of new applications to grow the TAM well ahead of already-robust projections. In addition, AI significantly lowers the dependence of silicon on software—AI is a silicon-based technology which can utilise every incremental transistor it is given. As we transition from mostly creating data, to actually analysing data, compute intensity is poised to accelerate underpinning a compute TAM CAGR of 10-15% up from 3-5% historically. Similar to declining cost curves in data creation, data storage and data transmission, as the cost of data analytics declines, we expect an elasticity of application explosion to underpin our view that the US$90 bn Compute TAM CAGR should accelerate. Top levered plays on compute: MU, NVDA, INTC, AMD and XLNX.

AI accelerators driving data centre investments

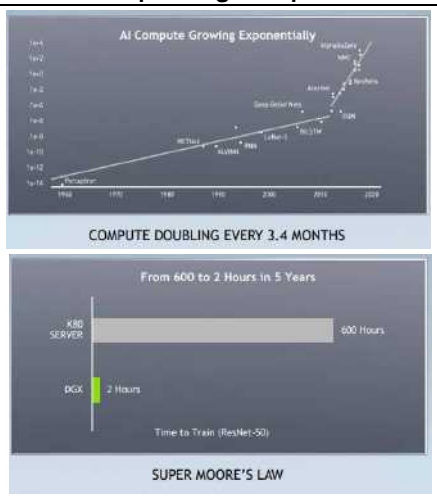
GPUs are increasingly being used in the data-centre/cloud as their parallel processing abilities increase the compute power which is lowering the cost vs. CPUs. NVDA and AMD's GPU sales to hyperscale customers for AI and deep learning applications began in 2012 with significant traction beginning in 2014. The growth estimates embedded in our TAM analysis are driven by impressive growth in AI server revenue. We expect overall accelerator revenue to deliver a ~65% CAGR from FY17-23, and we expect acceleration hardware to garner a significant portion of the revenues. NVIDIA estimates the AI training market TAM at US$10 bn and the AI inferencing market TAM at US$10 bn.

Figure 39: Inference adoption is growing



Source: NVIDIA

Figure 40: NVDA DGX expanding Compute TAM for AI

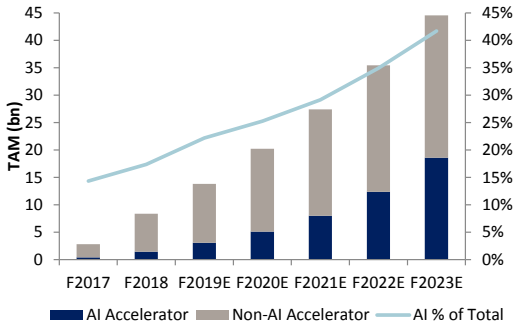


Source: NVIDIA

Finding AI leadership position in the cloud

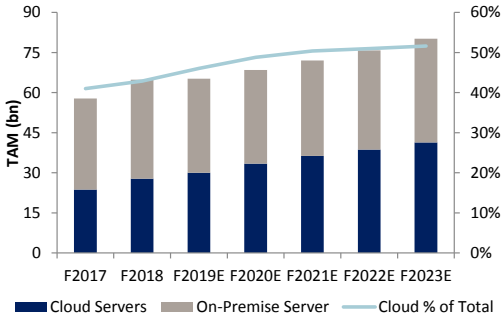
GPUs in the cloud empower AI scientists and researchers with GPU-accelerated containers and feature deep learning frameworks. NVDA's Volta has been chosen by every major cloud provider, which strengthens its leadership position in the space—with more than 2,000 companies using its platform. But AMD also has competitive offerings in the cloud market—again, we see this as a rising tide that should benefit all players. The most common industries from which these users have come to date are healthcare and transportation.

Figure 41: Total server accelerator and AI accelerator TAM



Source: IDC, Credit Suisse estimates.

Figure 42: Cloud compute servers as a % of total data centre servers



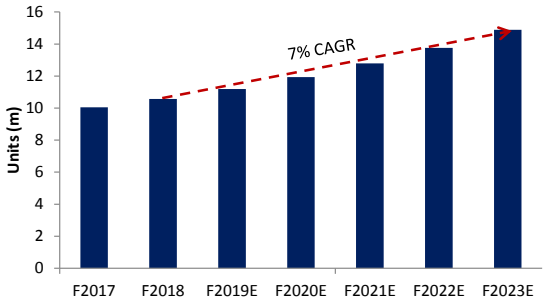
Source: IDC, Credit Suisse estimates.

Data science is the next high-performance computing growth opportunity

Data science is a rapidly growing field that expands the need for high-performance computing (HPC) intensity to a market of millions of professionals across almost any field—from science, healthcare, financial services and insurance to retail, logistics and travel. It is projected that demand for data scientists should rise >28% by 2020 alone. This new workload is expected to have a major impact on the HPC/server market, as demand for data science computing power is expected to more double over the next five years—growing the HPC TAM to ~US$50 bn.

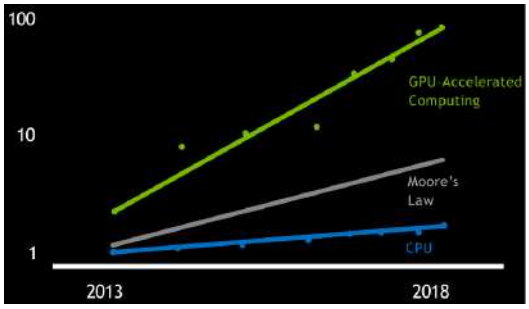
Data science could help the HPC/server TAM double to US$50 bn over the next five years

Figure 43: Server shipments are expected to continue increasing…



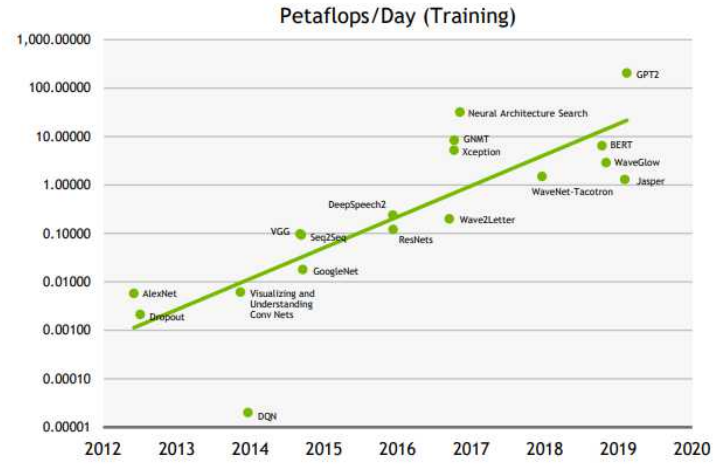
Source: IHS, Credit Suisse estimates

Figure 44: …as is accelerated computing



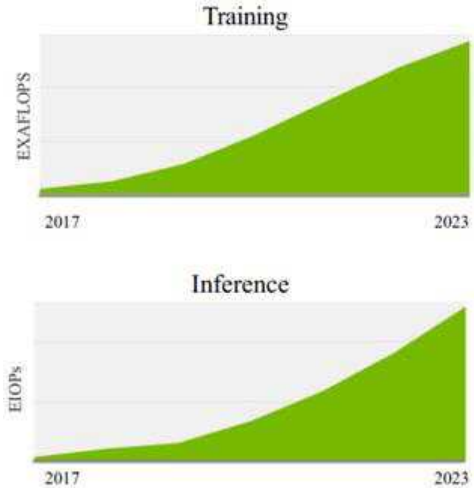
Source: NVIDIA

Figure 45: Network complexity is driving the market …



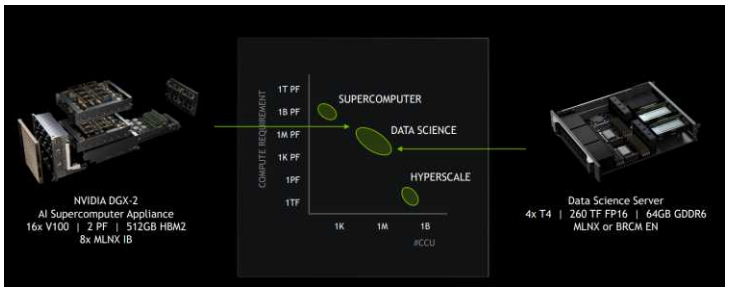
Source: NVIDIA

Figure 46: …along with AI and inference growth



Source: NVIDIA

Figure 47: Data Science is the next major HPC opportunity



Source: NVIDIA

Figure 48: AI applications across industries

Financial Technology	PayPal's Use of Machine Learning to Enhance Fraud Detection
Internet Services	Bing launches new intelligent search features, powered by AI
Entertainment	Comcast uses AI and ML for network insights
Medical Imaging	Deep Learning in Medical Ultrasound
Public Health	AI Helping Test Potential Treatments for Covid-19
Pharmaceuticals	AI shows promise for breast cancer screening
Climate	Using AI to Improve Real-Time High-Impact Weather Disaster Response

Source: Company data, Credit Suisse estimates

Cloud is driving growth for hyperscalers

CS now forecasts -1.9%/+8.7% unit server growth in CY20/21, with poor enterprise demand contrasting with much stronger demand from hyperscale/public cloud customers. For public cloud servers, growth has been very rapid over the past half-decade (including a +22.6% unit CAGR for 2015-18). This part of the market is also seeing benefits from the recent COVID-related acceleration in migration of applications away from 'on premise' to the cloud. We forecast public cloud server unit growth of 15%/14% YoY in CY20/21, in line with bottom-up strength forecast for hyperscale capex.

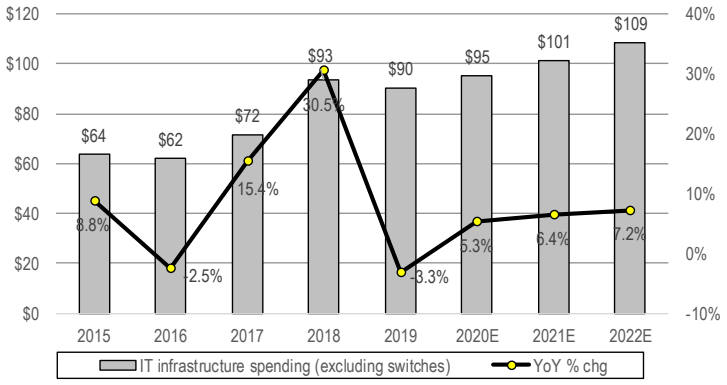
CS forecasts -2%/+9% overall server growth in 2020/21, but a higher +15%/+14% growth for public cloud servers

Overall capex spending from the global tier 1 hyperscalers slowed in late 2018/1H19 from the strong 2017-18 cycle to digest capacity, responding to a decline in memory pricing and growing concerns over macro-uncertainty as a result of the trade disputes between the US and China. Based on our cloud hyperscaler tracker, the aggregated capex spending of tier 1 cloud vendors was up only 2.1% YoY in 2019 against +36/66%% YoY growth in 2017/18. Following that lull, growth has rebounded with capex growth projected to be up 16% YoY to US$92 bn in 2020 and we expect the momentum could continue in 2021, up 19%/8% YoY in 2021/22 based on our conversations with Taiwan ODMs and supported by the internet service and cloud business growth. Overall, Cisco estimates there should be in total 628 hyperscale data centres by the end of 2021, vs 509 in 2019, representing an 11% CAGR. Most of these data centres are expected to reside within North America and Asia Pacific (each making up 30-40% of the total). Thus, servers residing in hyperscale data centres are expected to make up over 50% of the total installed servers in data centres globally by 2021(from 44% in 2019), representing 85% of total public cloud servers and 87% of public cloud workload and compute instances.

Enterprise server/storage to grow faster than IT infrastructure

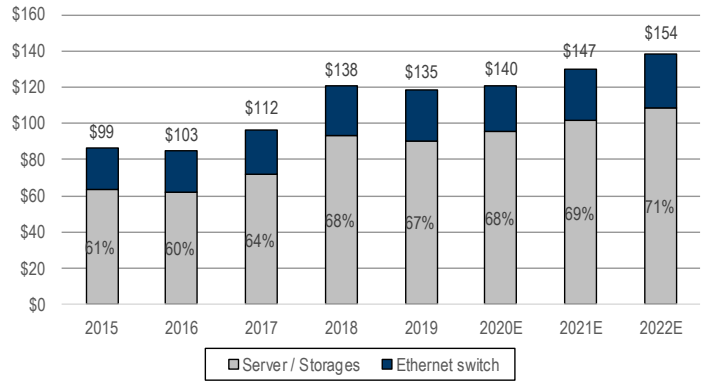
Within the IT infrastructure spending forecasts by IDC (discussed earlier in the previous section), it expects enterprise servers/storage expand at a faster 6.3% CAGR from 2019-22, vs the market's +4.5% CAGR. Overall, IT infrastructure spending on enterprise servers/storage is projected to represent 71% of the total mix in 2022, vs 67% in 2019. We believe Taiwan cloud IT infrastructure ODMs would be beneficiaries, as the markets increasingly adopt open-sourced platforms for greater workload and TCO optimisation starting from hyperscalers and CSP, followed by enterprises/telcos longer term, given ODMs' enhanced sophistication in: (1) custom hardware design; (2) flexibility in mass-scale manufacturing and system integration; and (3) global AM services coverage.

Figure 49: IT infrastructure spending, excluding Ethernet switches, to deliver a 6% CAGR from 2019-22
Sales in US$ bn (L-axis) and YoY % change (R-axis)



Source: Company data, IDC, Credit Suisse

Figure 50: Server and storage making up a growing proportion of global IT infrastructure spending reaching 71% by 2022
Sales in US$ bn and % of mix

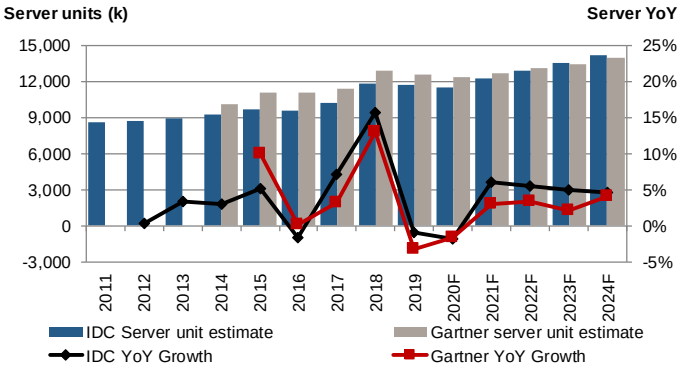


Source: Company data, IDC, IHS, Credit Suisse

Server revenue growth, which would drive the supply chain's revenue opportunity and mix of components, has been at a premium to server unit growth over the past decade and projected to continue at that higher growth rate. From 2011-19, IDC estimates server units delivered a 4% CAGR and revenue a 7% CAGR while Gartner estimates units saw a 4% CAGR and revenue had a 5% CAGR.

Server units have maintained a 4% CAGR the past decade, though ODMs and hyperscalers segments have grown much faster

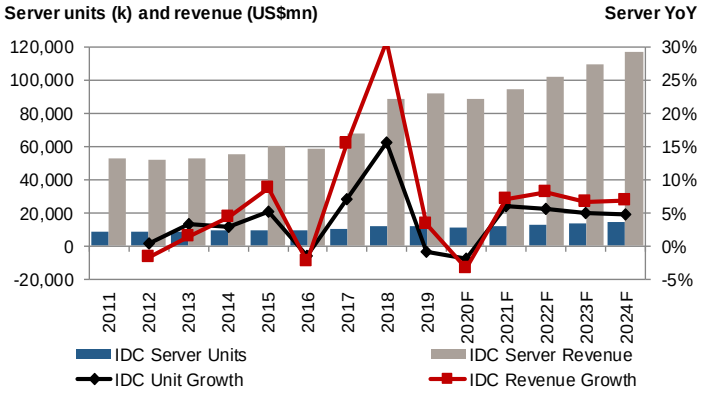
Figure 51: IDC/Gartner project server units to deliver low single-digit growth



Source: IDC, Gartner

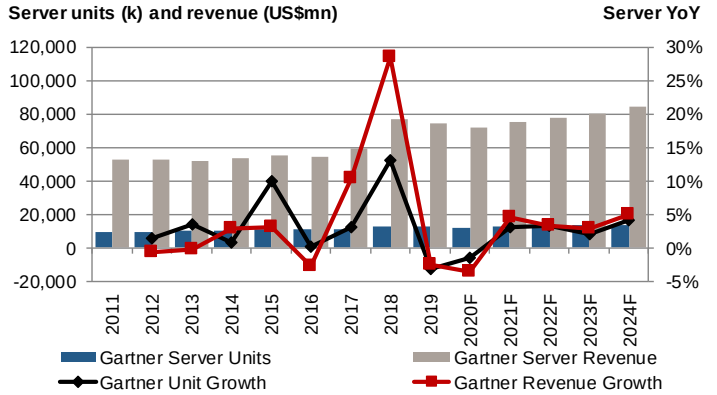
For the forecast period from 2019-24, IDC has a one point premium with units +4% and revenue +5% while Gartner only projects +2% for units and revenue, though it does have revenue growth accelerating one percentage point after 2020.

Figure 52: IDC projects server revenue growth faster than units



Source: IDC

Figure 53: Gartner also projects slightly faster server revenue

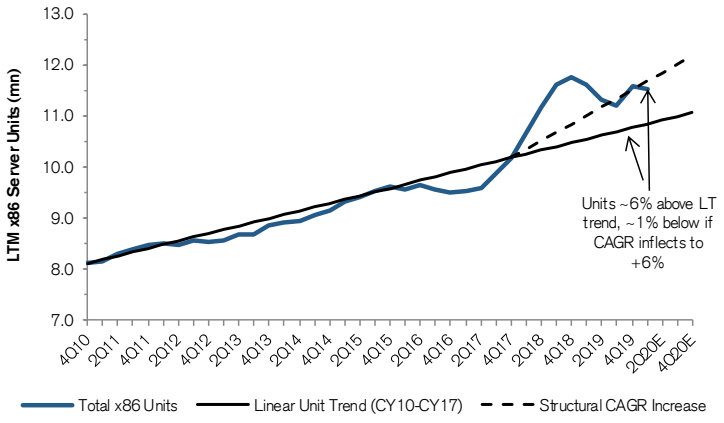


Source: Gartner

CS forecasts robust public cloud server growth

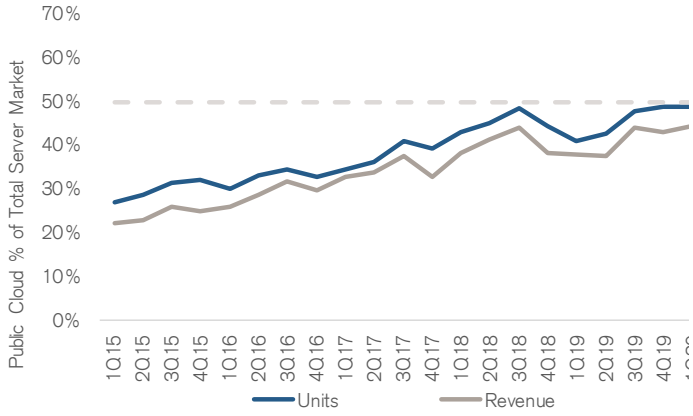
Our new server forecasts reflect our view that enterprise demand is under pressure both near term (weak macro due to COVID-19) and longer term (given accelerating public cloud adoption), contrasting with much stronger future demand from hyperscale/public cloud customers. Overall, we now forecast server unit growth of -1.9%/+8.7% in CY20/CY21. Contributing further to the weakness in CY20 is the ongoing digestion of well above-trend sales in CY17/18; we estimate that LTM x86 server units are ~6% above their long-term trend (using the 3% CAGR from 2010-17) despite a relatively weak CY19 (units -0.9% YoY). Even if we assume LT TAM growth doubles to +6% given the rising value of data, LTM shipments have only returned to trend rather than moving below to absorb the excess capacity sold during 2017/18.

Figure 54: LTM x86 server shipments still stand ~6% above their LT trend after a strong CY17-18; ~1% below if CAGR inflects



Source: IDC, Credit Suisse estimates

Figure 55: Public cloud demand has been steadily rising within the server mix; we expect it to surpass enterprise in CY20



Source: IDC, Credit Suisse estimates

Given that traditional enterprise and public cloud are effectively two distinct segments within the server market, with unique growth drivers and market dynamics, we are introducing a new forecast methodology that explicitly breaks them apart. Within each of these categories, we estimate the growth of both custom (~70%/5% of public/enterprise) and standard (~30%/95%) units, which then roll up to the total segment numbers. Public cloud servers have become an increasingly important part of the overall market, at nearly 50% of units (and ~45% of revenue) as of 1Q20; we expect this trend to continue, anticipating public cloud to represent the majority (>55%) of all servers sold by next year.

Figure 56: We expect strong growth in public cloud (led by hyperscale) to largely offset weakness in enterprise demand

Credit Suisse Server Model	2016	2017	2018	2019	2020E	2021E	'15-'18 CAGR	'18-'21E CAGR
Shipments (units, '000s)								
Public Cloud Servers	**3,133**	**3,900**	**5,377**	**5,350**	**6,163**	**7,007**	**22.6%**	**9.2%**
y/y % ch	*7.3%*	*24.5%*	*37.9%*	*-0.5%*	*15.2%*	*13.7%*		
% of Total	32.8%	38.1%	45.4%	45.6%	53.5%	56.0%		
Custom-Built	*1,633*	*2,294*	*3,116*	*3,695*	*4,422*	*5,127*	*22.6%*	*18.0%*
y/y % ch	*-3.5%*	*40.5%*	*35.8%*	*18.5%*	*19.7%*	*15.9%*		
% of Public Cloud	52.1%	58.8%	58.0%	69.1%	71.8%	73.2%		
Standard	*1,500*	*1,606*	*2,261*	*1,656*	*1,741*	*1,880*	*22.6%*	*-6.0%*
y/y % ch	*22.3%*	*7.1%*	*40.7%*	*-26.8%*	*5.1%*	*8.0%*		
% of Public Cloud	47.9%	41.2%	42.0%	30.9%	28.2%	26.8%		
Traditional Enterprise Servers	**6,425**	**6,341**	**6,472**	**6,395**	**5,357**	**5,511**	**-1.6%**	**-5.2%**
y/y % ch	*-5.4%*	*-1.3%*	*2.1%*	*-1.2%*	*-16.2%*	*2.9%*		
% of Total	67.2%	61.9%	54.6%	54.4%	46.5%	44.0%		
Custom-Built	*140*	*231*	*296*	*347*	*234*	*261*	*25.4%*	*-4.1%*
y/y % ch	*-6.3%*	*64.7%*	*27.8%*	*17.2%*	*-32.3%*	*11.2%*		
% of Enterprise	2.2%	3.6%	4.6%	5.4%	4.4%	4.7%		
Standard	*6,284*	*6,109*	*6,176*	*6,048*	*5,122*	*5,251*	*-2.4%*	*-5.3%*
y/y % ch	*-5.4%*	*-2.8%*	*1.1%*	*-2.1%*	*-15.3%*	*2.5%*		
% of Enterprise	97.8%	96.4%	95.4%	94.6%	95.6%	95.3%		
Total Server Shipments (units, '000s)	**9,557**	**10,241**	**11,849**	**11,745**	**11,520**	**12,518**	**6.9%**	**1.8%**
y/y % ch	*-1.6%*	*7.2%*	*15.7%*	*-0.9%*	*-1.9%*	*8.7%*		
Revenue ($ mn)								
Public Cloud Servers	**$17,164**	**$23,291**	**$36,094**	**$35,803**	**$41,440**	**$48,513**	**35.2%**	**10.4%**
y/y % ch	*17.6%*	*35.7%*	*55.0%*	*-0.8%*	*15.7%*	*17.1%*		
% of Total	29.2%	34.3%	40.6%	41.0%	48.6%	51.2%		
Custom-Built	$10,258	$14,750	$21,723	$23,574	$28,163	$33,455	*31.6%*	*15.5%*
y/y % ch	*7.6%*	*43.8%*	*47.3%*	*8.5%*	*19.5%*	*18.8%*		
% of Public Cloud	59.8%	63.3%	60.2%	65.8%	68.0%	69.0%		
Standard	$6,906	$8,541	$14,371	$12,229	$13,278	$15,058	*41.6%*	*1.6%*
y/y % ch	*36.5%*	*23.7%*	*68.3%*	*-14.9%*	*8.6%*	*13.4%*		
% of Public Cloud	40.2%	36.7%	39.8%	34.2%	32.0%	31.0%		
Traditional Enterprise Servers	**$41,677**	**$44,593**	**$52,722**	**$51,498**	**$43,752**	**$46,231**	**5.0%**	**-4.3%**
y/y % ch	*-8.6%*	*7.0%*	*18.2%*	*-2.3%*	*-15.0%*	*5.7%*		
% of Total	70.8%	65.7%	59.4%	59.0%	51.4%	48.8%		
Custom-Built	$877	$1,505	$2,533	$2,599	$1,747	$1,992	*35.0%*	*-7.7%*
y/y % ch	*-14.8%*	*71.6%*	*68.3%*	*2.6%*	*-32.8%*	*14.0%*		
% of Enterprise	2.1%	3.4%	4.8%	5.0%	4.0%	4.3%		
Standard	$40,800	$43,088	$50,189	$48,899	$42,005	$44,239	*4.1%*	*-4.1%*
y/y % ch	*-8.4%*	*5.6%*	*16.5%*	*-2.6%*	*-14.1%*	*5.3%*		
% of Enterprise	97.9%	96.6%	95.2%	95.0%	96.0%	95.7%		
Total Server Revenue ($ mn)	**$58,841**	**$67,885**	**$88,816**	**$87,300**	**$85,192**	**$94,743**	**13.9%**	**2.2%**
y/y % ch	*-2.2%*	*15.4%*	*30.8%*	*-1.7%*	*-2.4%*	*11.2%*		

Source: IDC, Credit Suisse estimates

Figure 57: Overall, we expect server unit growth of -1.9%/+8.7% YoY in CY20/CY21

Credit Suisse Server Model	2016	2017	2018	2019	2020E	2021E	'15-'18 CAGR	'18-'21E CAGR
Shipments (units, '000s)								
x86	**9,494**	**10,180**	**11,754**	**11,600**	**11,280**	**12,212**	**6.9%**	**1.3%**
y/y % ch	*-1.4%*	*7.2%*	*15.5%*	*-1.3%*	*-2.8%*	*8.3%*		
% of Total	99.3%	99.4%	99.2%	98.8%	97.9%	97.6%		
Linux	*3,924*	*4,863*	*6,203*	*6,360*	*6,873*	*7,878*	*17.3%*	*8.3%*
y/y % ch	*2.2%*	*23.9%*	*27.6%*	*2.5%*	*8.1%*	*14.6%*		
% of Total	41.1%	47.5%	52.3%	54.2%	59.7%	62.9%		
Windows	*5,553*	*5,306*	*5,538*	*5,226*	*4,393*	*4,322*	*-1.3%*	*-7.9%*
y/y % ch	*-3.7%*	*-4.5%*	*4.4%*	*-5.6%*	*-15.9%*	*-1.6%*		
% of Total	58.1%	51.8%	46.7%	44.5%	38.1%	34.5%		
RISC/EPIC (POWER, SPARC, etc)	**55**	**43**	**40**	**38**	**37**	**38**	**-17.2%**	**-1.6%**
y/y % ch	*-22.3%*	*-22.1%*	*-6.2%*	*-6.5%*	*-1.7%*	*3.5%*		
% of Total	0.6%	0.4%	0.3%	0.3%	0.3%	0.3%		
Mainframe/other	**8**	**18**	**55**	**107**	**203**	**268**	**69.4%**	**69.2%**
y/y % ch	*-26.6%*	*111.9%*	*212.4%*	*93.6%*	*90.1%*	*31.7%*		
% of Total	0.1%	0.2%	0.5%	0.9%	1.8%	2.1%		
Total Server Shipments (units, '000s)	**9,557**	**10,241**	**11,849**	**11,745**	**11,520**	**12,518**	**6.9%**	**1.8%**
y/y % ch	*-1.6%*	*7.2%*	*15.7%*	*-0.9%*	*-1.9%*	*8.7%*		
Revenue ($ mn)								
x86	**$51,479**	**$60,289**	**$81,106**	**$80,005**	**$75,844**	**$83,142**	**17.4%**	**0.8%**
y/y % ch	*2.7%*	*17.1%*	*34.5%*	*-1.4%*	*-5.2%*	*9.6%*		
% of Total	87.5%	88.8%	91.3%	91.6%	89.0%	87.8%		
Linux	$22,948	$29,899	$42,621	$42,775	$45,131	$52,630	*25.4%*	*7.3%*
y/y % ch	*6.2%*	*30.3%*	*42.5%*	*0.4%*	*5.5%*	*16.6%*		
% of Total	39.0%	44.0%	48.0%	49.0%	53.0%	55.6%		
Windows	$28,083	$30,006	$38,342	$37,062	$30,545	$30,357	*11.0%*	*-7.5%*
y/y % ch	*0.2%*	*6.8%*	*27.8%*	*-3.3%*	*-17.6%*	*-0.6%*		
% of Total	47.7%	44.2%	43.2%	42.5%	35.9%	32.0%		
RISC/EPIC (POWER, SPARC, etc)	**$4,058**	**$3,648**	**$3,823**	**$3,249**	**$2,994**	**$3,247**	**-10.7%**	**-5.3%**
y/y % ch	*-24.3%*	*-10.1%*	*4.8%*	*-15.0%*	*-7.8%*	*8.4%*		
% of Total	6.9%	5.4%	4.3%	3.7%	3.5%	3.4%		
Mainframe/other	**$3,304**	**$3,947**	**$3,886**	**$4,046**	**$6,354**	**$8,354**	**-6.0%**	**29.1%**
y/y % ch	*-29.3%*	*19.5%*	*-1.5%*	*4.1%*	*57.0%*	*31.5%*		
% of Total	5.6%	5.8%	4.4%	4.6%	7.5%	8.8%		
Total Server Revenue ($ mn)	**$58,841**	**$67,885**	**$88,816**	**$87,300**	**$85,192**	**$94,743**	**13.9%**	**2.2%**
y/y % ch	*-2.2%*	*15.4%*	*30.8%*	*-1.7%*	*-2.4%*	*11.2%*		

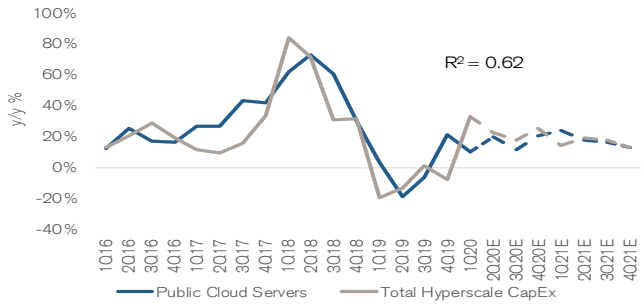
Source: IDC, Credit Suisse estimates

Public cloud servers: Robust growth

Cloud servers have maintained a 23% CAGR from 2015-18 and are tightly correlated to hyperscale capex

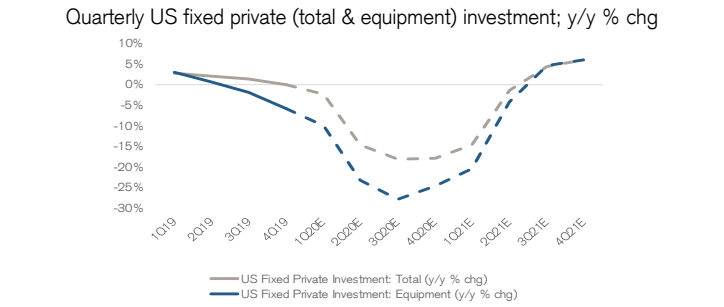
For public cloud servers, growth has been very rapid over the past half-decade (including a +22.6% unit CAGR for 2015-18), with this growth tightly correlated to increases in hyperscale capex spend over that time (1Q16-1Q20 R^2 = 0.62). This part of the market is also seeing benefits from the recent COVID-19-related acceleration in migration of applications away from on-prem; we believe this impact would remain even once things return to "normal" post-COVID. We also factor in the pending Ice Lake CPU release from Intel, which is expected to launch in 4Q20, albeit with a potential slowdown in 3Q ahead of its introduction. Incorporating all these factors, we anticipate robust public cloud server growth (+15.2%/ +13.7% YoY in CY20/21) through our forecast period, in line with bottom-up strength forecast for hyperscale capex.

Figure 58: Growth in public cloud servers is tightly correlated to total hyperscale capex



Source: Company data, Credit Suisse estimates

Figure 59: US fixed asset investment more of a "U" than a "V" based on our US econ forecasts; a drag on enterprise demand



Source: Company data, Credit Suisse estimates

Cautious on overall enterprise hardware spend

Enterprise spending is slower, with servers -16.2% in 2020 but expected to rebound +2.9% YoY on gradual normalisation in 2021

We are cautious on both servers and storage enterprise hardware spend as the initial COVID bump to WFH/BCP demand fades and gives way to a weak macro backdrop which, in turn, puts pressure on IT budgets for at least the balance of CY20. In particular, we expect enterprise server demand to be meaningfully sub-seasonal in 2Q20 (-1.5% QoQ vs the +4.1% average) despite a weak 1Q, mirroring comments from distributor Synnex (that servers underperformed during their May quarter) and Dell ("[infrastructure spend] did ramp in April, but not at historical norms"). Looking at the rest of CY20, we view a "snap-back" as unlikely in 2H and expect more normal seasonality off a very low base (enterprise -17.3%/-17.8% YoY in 3Q/4Q). Overall we forecast CY20 enterprise units at -16.2% YoY. Heading into CY21, we are forecasting a gradual normalisation over the course of the year, with enterprise units up +2.9% YoY.

Longer term, accelerating cloud adoption represents a headwind to traditional on-prem hardware spending, adding incremental pressure to enterprise units. From a vendor perspective, we view weak enterprise server demand as a negative for HPE (servers >50% of mix) and Dell (16% of total mix and 18% ex-VMware); however, we significantly prefer Dell's positioning in a hybrid-first world due to its strategic ties with VMware vs. HPE's overly on-prem-centric mix.

Figure 60: ODM Direct (driven by outsized hyperscale demand) has taken significant market share over the past few years

Unit Share	1Q18	2Q18	3Q18	4Q18	1Q19	2Q19	3Q19	4Q19	1Q20	Y/Y Change	Q/Q Change
ODM Direct	25.4%	24.7%	27.7%	23.1%	25.2%	25.2%	29.2%	31.0%	29.1%	387bps	-188bps
Dell Technologies	20.4%	19.4%	17.6%	19.4%	20.0%	17.8%	16.4%	16.1%	18.4%	-163bps	226bps
Hewlett Packard Enterprise	14.0%	12.7%	11.6%	12.8%	12.6%	13.0%	11.1%	11.0%	11.4%	-121bps	46bps
HPE + H3C	*20.4%*	*20.8%*	*20.4%*	*21.2%*	*18.1%*	*19.6%*	*20.5%*	*22.6%*	*16.9%*	*-127bps*	*-579bps*
Inspur	6.4%	6.8%	8.9%	8.3%	7.9%	8.6%	10.2%	7.9%	8.2%	27bps	27bps
Lenovo	5.9%	7.6%	6.1%	6.4%	5.3%	6.7%	6.6%	6.9%	6.0%	64bps	-91bps
Cisco	2.5%	2.3%	2.2%	2.4%	2.8%	2.4%	2.3%	2.4%	2.1%	-76bps	-29bps
Others	25.4%	26.5%	25.9%	27.6%	26.0%	26.2%	24.2%	24.8%	24.8%	-118bps	9bps

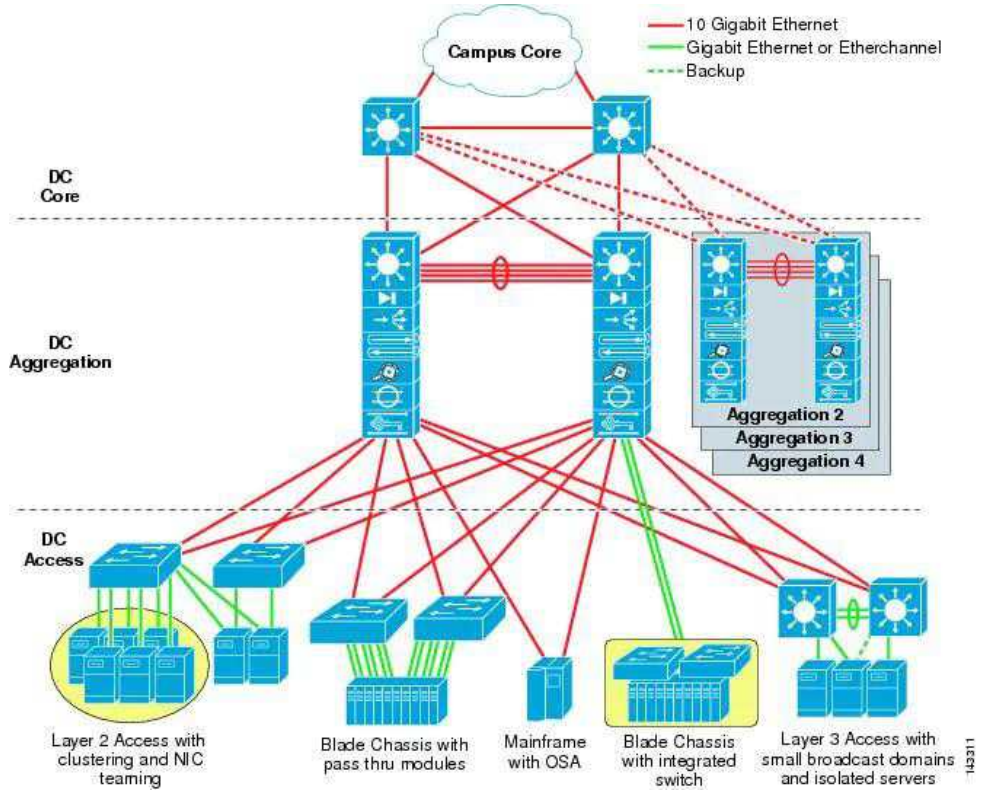
Revenue Share	1Q18	2Q18	3Q18	4Q18	1Q19	2Q19	3Q19	4Q19	1Q20	Y/Y Change	Q/Q Change
ODM Direct	24.2%	24.2%	26.7%	19.9%	23.0%	21.1%	26.3%	25.5%	25.9%	295bps	41bps
Dell Technologies	19.3%	19.3%	17.9%	18.8%	20.2%	18.9%	17.1%	15.7%	18.7%	-151bps	294bps
Hewlett Packard Enterprise	16.3%	14.3%	13.7%	15.3%	15.0%	14.9%	13.1%	12.7%	12.5%	-254bps	-20bps
HPE + H3C	*18.5%*	*16.5%*	*16.1%*	*17.8%*	*17.8%*	*18.0%*	*16.9%*	*16.3%*	*15.5%*	*-224bps*	*-78bps*
Inspur	4.7%	4.8%	7.1%	6.3%	5.9%	6.8%	8.6%	6.5%	7.0%	107bps	51bps
Lenovo	5.7%	6.8%	6.1%	6.2%	5.7%	6.0%	5.4%	5.6%	5.6%	-11bps	-1bps
Cisco	5.2%	4.8%	4.4%	4.6%	5.3%	5.5%	4.9%	4.4%	4.2%	-108bps	-17bps
Others	24.5%	25.7%	24.2%	28.9%	24.9%	26.7%	24.5%	29.6%	26.1%	121bps	-350bps

Source: Company data, Credit Suisse estimates

Types of data centres

As per Cisco, "a data-centre is a physical facility that organisations use to house their critical applications and data. A data centre's design is based on a network of computing and storage resources that enable the delivery of shared applications and data."

Figure 61: Data-centre multi-tier model topology

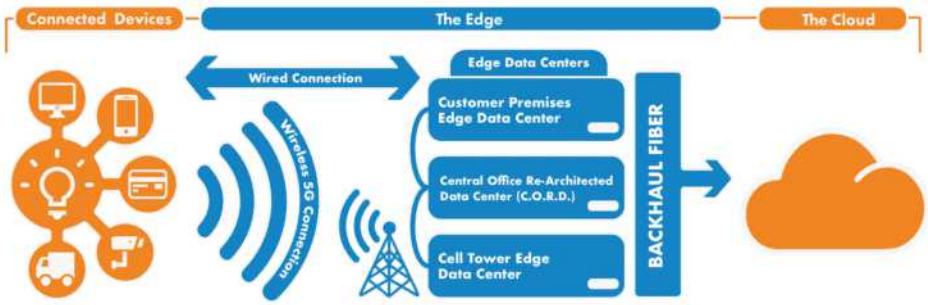


Source: Cisco

While there is no hard and fast way of classifying data centres, in general, they are classified as follows:

- **Enterprise data centres.** These are probably the 'oldest' form of data centres that most people are aware of and date back to the early years of the evolution of computing architecture. An enterprise data centre is a facility owned and operated by the company it supports and is often built on site but can be off site in certain cases. It is optimised for its end users.
- **Managed services data centres.** These are essentially enterprise data centres where the management of the data centre has been outsourced to another party—in older days, it used to be tech-heavyweights such as IBM and HP among others, but a number of managed services providers have emerged over the years. The end-user company usually leases the equipment and infrastructure instead of buying it.
- **Colocation data centres.** These grew out of the above two type of data centres about 20 years ago as companies wanted to retain control of some key operations while outsourcing the rest. As per Cisco's definition: "in colocation ("colo") data centres, a company rents space within a data centre owned by others and located off company premises. The colocation data centre hosts the infrastructure: building, cooling, bandwidth, security, etc., while the company provides and manages the components, including servers, storage and firewalls." One added advantage of a 'colo' data centre is the ability to connect with other companies' servers, which maybe co-located at the same data centre, thus minimising latency and connectivity issues. Interconnection is a large driver for businesses. Colocation data centres offer interconnection to SaaS such as salesforce, or PaaS like Azure. This enables businesses to scale and grow their business with minimal complexity at a low cost.
- **Wholesale data centres.** These started to emerge by the late 2000s with the emergence of larger 'internet' companies, as they wanted a much larger proportion of the 'colo' capacity at any given data centre. These facilities are commonly referred to as multi-tenant data centres (MTDC). Wholesale colocation data centres consist of one owner selling space, power and cooling to enterprise and hyperscale, like standard colocation. In most cases wholesale colocation provides the space, power and cooling.
- **Hyperscale data centres (or cloud data centres).** These have been the fast growing part of the data-centre universe and are the focus of most of our discussions in the next several sections. With the emergence of cloud service providers, such as AWS, Microsoft, Google and Alibaba, there came the need for such hyperscale data centres. A hyperscale data centre is a facility owned and operated by the company it supports. They offer robust, scalable applications and a storage portfolio of services to individuals or businesses. Hyperscale computing is necessary for cloud and big data storage. Such data centres have upwards of 500 cabinets (and more than 5,000 servers) and are at least 10,000 sq ft. in size (aflhyperscale.com).
- **Edge data centres.** These are the newest type of data centre class that has started to emerge in recent years and is expected to accelerate significantly, as 5G ramps along with its attendant use cases that would require significantly lower latency rates than is available through current network and cloud architecture. An edge data centre is a self-functioning data centre that holds localised IT deployments for cloud services, with compute, storage, and analytics resources for application processing and data caching. It would include the same power, cooling, connectivity, and security features that one finds in a centralised data centre, but on a smaller scale. Such an edge data centre resides on the outer edges of an IP network and handles the processing of applications, data analytics, and data storage closer to the end users, and devices that use those applications and data.

Figure 62: A typical layout for an edge computing architecture

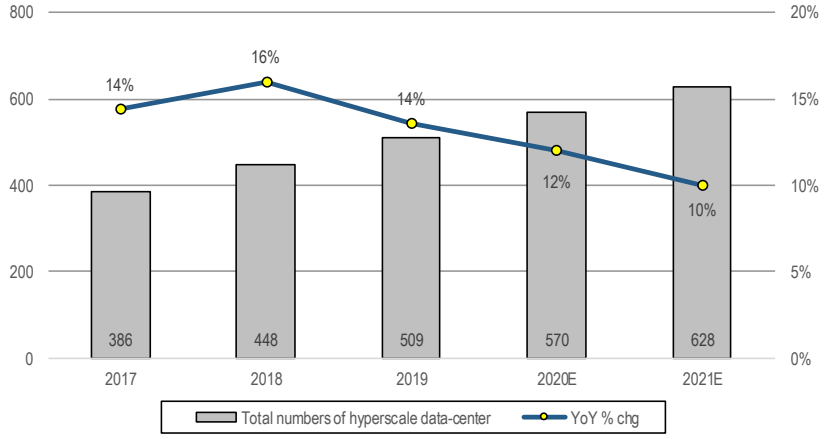


Source: connectorsupplier.com

Hyperscalers growing much faster than overall servers

We believe data traffic growth has been further accelerated by COVID-19 leading to the increasing build of cloud data centres and open-sourced hardware demand for compute, storage and networking especially by the globally leading hyperscalers. A hyperscale cloud operator is defined by Cisco as a company with: (1) more than US$1 bn in annual sales for SaaS, PaaS or IaaS; (2) more than US$2 bn in annual sales from SaaS; (3) more than US$4 bn in annual sales from internet, search and social networking; and (4) more than US$8 bn in annual sales from e-commerce/payment processing. Overall, it estimates there are in total 24 hyperscale operators globally, with only 7 of these headquartered outside of the US. Cisco forecasts there to be in total 628 hyperscale data centres by the end of 2021, vs 509 in 2019, representing an 11% CAGR. Most of the data centres, according to Cisco, are expected to reside within North America and Asia Pacific, with each making up 30-40% of the total hyperscale data centre count, followed by Europe at 15-20%.

Figure 63: Global hyperscale data centres to deliver an 11% CAGR from 2019-21
Number of hyperscale data centres (L-axis) and YoY % change (R-axis)

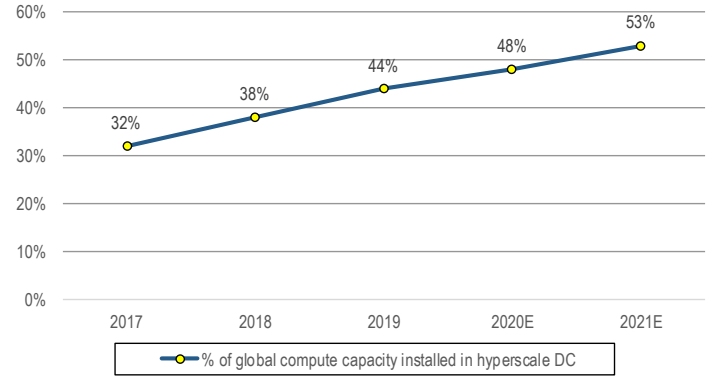


Source: Company data, Cisco, Credit Suisse

Cisco estimates hyperscale will reach 50% of installed servers in data centres by 2021, up from 44% in 2019

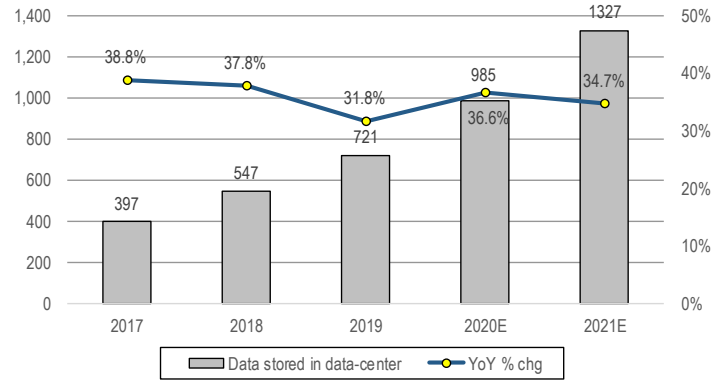
Cisco expects servers residing in hyperscale data centres to make up more than 50% of the total installed servers in data centres globally by 2021, up from 44% in 2019, representing 85% of the total public cloud server installed base and 87% of public cloud workload and compute instances. Similarly, it also expects data flow in data centres to deliver more than a 35% CAGR from 2019-21 and total data-centre storage capacity to grow by four-fold from 2016-21, reaching 2.6 ZB/year by 2021. We believe the majority of this storage capacity expansion would be owned by the hyperscalers, which would drive a better demand uptick for open-sourced cloud IT infrastructure, with Taiwan ODMs as key beneficiaries.

Figure 64: Hyperscale data centres to make up more than 50% of global compute capacities in data centres by 2021
% of global servers installed in hyperscale data centres



Source: Company data, Cisco, Credit Suisse

Figure 65: Data stored within data centres to surge by more than a 35% CAGR from 2019-21, driving hiking cloud storage demand
Data in ZB/year (L-axis) and YoY % change (R-axis)

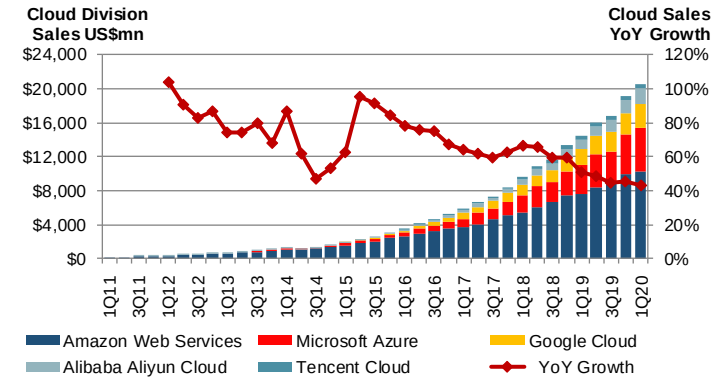


Source: Company data, Cisco, Credit Suisse

Cloud and internet growth supports hyperscale spend

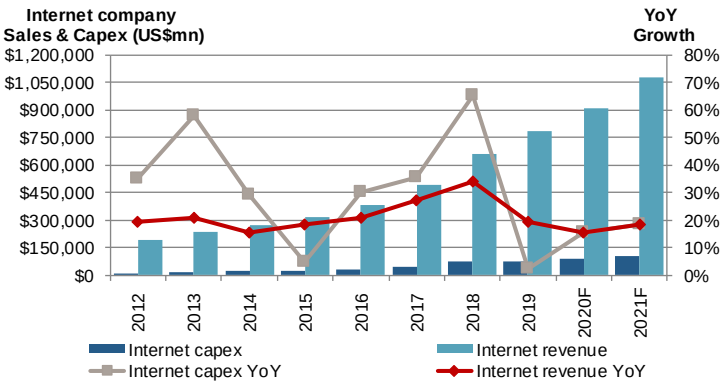
Relative to those modest market growth estimates for the overall server market, which includes mature enterprise, the growth in cloud and internet service revenue points to faster potential growth for that market tier. The cloud growth at the top operators—Microsoft, Amazon, Google and Alibaba—remained over 40% YoY through 1Q20. Overall revenue growth for these companies' overall businesses, which include the social networking, gaming and e-commerce portions, also remains healthy, and is projected to grow +16% YoY to US$911 bn in 2020 and a further +19% YoY to US$1.08 tn in 2021. The strong growth in their own service plus hosted cloud workloads should require a high level of spend continuing from these channels.

Figure 66: Cloud service growth at >40% supports spending



Source: IDC

Figure 67: Internet service growth supports continued capex



Source: Gartner

Hyperscale capex spending rebounding in 2020-21

Overall capex spending from the global tier 1 hyperscalers slowed in late 2018/1H19 from the strong 2017-18 cycle to digest capacity, responding to declining memory pricing and growing concerns over macro-uncertainty as a result of the lingering trade negotiations between the US and China. Based on our cloud hyperscaler tracker, the aggregated capex spending of tier 1 cloud vendors—including Facebook, Google, Amazon and Microsoft in the US, and Baidu, Alibaba and Tencent in China—amounted to US$78.9 bn in 2019, up 2.1% YoY, a pause from the +36% YoY growth in 2017 and 65% YoY growth in 2018.

Hyperscale capex slowed to +2% YoY in 2019 but is now rebounding and we project +17%/+17% YoY growth in 2020-21 led by hosted services

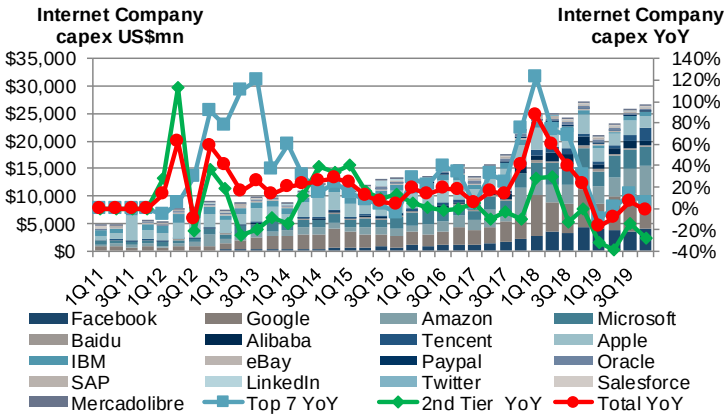
Figure 68: Capex for the hyperscale/internet companies projected to rebound from -5% in 2019 to +17%/+17%/6% for 2020-22

Top 7 Hyperscale Capex	1Q19	2Q19	3Q19	4Q19	1Q20	2016	2017	2018	2019	2020F	2021F	2022F
Facebook	$3,962	$3,775	$3,676	$4,100	$3,558	$4,491	$6,733	$13,915	$15,513	$15,000	$18,582	$19,452
Google	$4,638	$6,126	$6,732	$6,052	$6,005	$10,212	$13,184	$25,139	$23,548	$22,371	$28,084	$30,202
Amazon	$3,290	$3,562	$4,697	$5,312	$6,795	$6,737	$11,955	$13,426	$16,861	$21,177	$23,186	$24,882
Microsoft	$2,565	$4,051	$3,385	$3,545	$3,767	$9,114	$8,696	$14,223	$13,546	$16,867	$19,254	$22,394
Baidu	$442	$198	$170	$126	$77	$630	$707	$1,322	$936	$1,890	$2,139	$2,149
Alibaba	$847	$853	$1,284	$825	$548	$1,495	$3,467	$5,534	$3,809	$7,677	$9,550	$9,440
Tencent	$656	$639	$947	$2,410	$860	$1,822	$2,020	$3,648	$4,653	$6,601	$7,711	$8,808
Top 7 Hyperscale capex	**$16,400**	**$19,204**	**$20,891**	**$22,370**	**$21,610**	**$34,500**	**$46,763**	**$77,207**	**$78,866**	**$91,583**	**$108,506**	**$117,327**
YoY Growth	**-10.6%**	**1.2%**	**13.1%**	**4.5%**	**31.8%**	**30.1%**	**35.5%**	**65.1%**	**2.1%**	**16.1%**	**18.5%**	**8.1%**
QoQ Growth	**-23.4%**	**17.1%**	**8.8%**	**7.1%**	**-3.4%**							
Apple	$2,363	$2,000	$2,777	$2,107	$1,853	$12,962	$12,121	$13,858	$9,247	$10,469	$12,483	$10,971
IBM	$614	$431	$681	$729	$783	$4,150	$3,773	$3,895	$2,455	$3,465	$3,380	$3,308
eBay	$182	$137	$96	$139	$98	$626	$666	$651	$554	$486	$537	$563
Paypal	$218	$139	$173	$174	$206	$669	$667	$823	$704	$938	$1,107	$1,386
Oracle	$443	$413	$386	$349	$396	$1,604	$2,037	$1,468	$1,591	$1,960	$2,042	$2,102
SAP	$359	$180	$182	$126	$367	$1,105	$1,443	$1,630	$848	$1,195	$1,228	$1,289
LinkedIn	In MSFT	In MSFT	In MSFT	In MSFT	In MSFT	$687	In MSFT	In MSFT	In MSFT	In MSFT	In MSFT	In MSFT
Twitter	$83	$136	$170	$152	$123	$219	$161	$484	$541	$635	$623	$642
Salesforce	$167	$159	$178	$170	$136	$388	$540	$566	$674	$813	$954	$1,139
Mercadolibre	$33	$38	$20	$49	$45	$77	$75	$90	$141	$181	$231	$295
2nd Tier Hyperscale capex (US$mn)	**$4,462**	**$3,633**	**$4,664**	**$3,995**	**$4,007**	**$22,487**	**$21,483**	**$23,465**	**$16,754**	**$20,142**	**$22,585**	**$21,695**
YoY Growth	**-32.3%**	**-38.5%**	**-13.8%**	**-28.0%**	**-10.2%**	**0.6%**	**-4.5%**	**9.2%**	**-28.6%**	**20.2%**	**12.1%**	**-3.9%**
QoQ Growth	**-19.6%**	**-18.6%**	**28.4%**	**-14.3%**	**0.3%**							
Total Hyperscale capex (US$mn)	**$20,862**	**$22,838**	**$25,555**	**$26,365**	**$25,617**	**$56,987**	**$68,246**	**$100,673**	**$95,620**	**$111,725**	**$131,091**	**$139,022**
YoY Growth	**-16.3%**	**-8.3%**	**7.0%**	**-2.2%**	**22.8%**	**16.7%**	**19.8%**	**47.5%**	**-5.0%**	**16.8%**	**17.3%**	**6.0%**
QoQ Growth	**-22.6%**	**9.5%**	**11.9%**	**3.2%**	**-2.8%**							

Note: 2020 based on guidance where given or Consensus, 2021-22 based on Factset Consensus. Source: Company data, Credit Suisse estimates

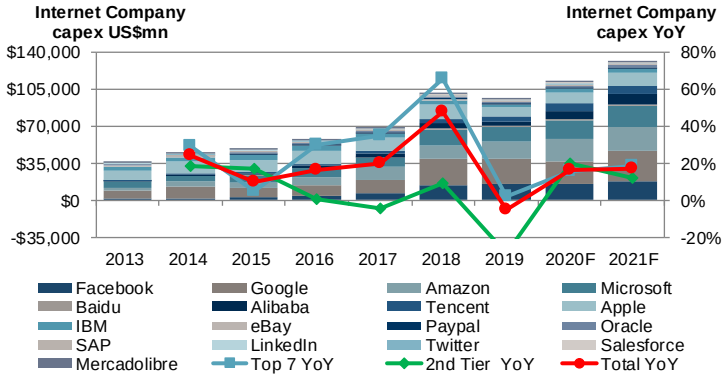
Following that lull, growth has rebounded with capex growth projected to be up 16% YoY to US$92 bn in 2020. We expect this momentum could continue in 2021, up 19% YoY to US$109 bn and up 8% YoY in 2022 to US$117 bn, based on our conversations with Taiwan ODMs and supported by the internet service and cloud business growth.

Figure 69: Capex rebounding from the 2019 slowdown



Source: Company data

Figure 70: Cloud capex targeted to grow in mid-teens for 2020-21



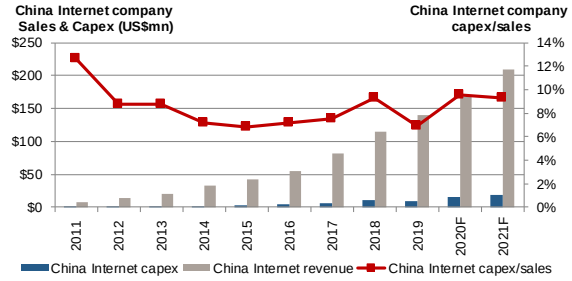
Source: Company data, Credit Suisse estimates

Among the hyperscalers, Google could come back from a slowdown this year tied also to slowing advertisement budgets and Facebook and Arista have also noted some project delays from COVID-19 and slower readiness of 400G optical modules. We expect some pick-up in data centre construction as COVID-19 restrictions also ease and companies develop new business continuity strategies for their network to manage for future disruptions and handle surge traffic demands. Factoring in the 2nd tier internet companies, overall capex would be set to rebound from -5% YoY at US$96 bn in 2019 and grow +17% in 2020 to US$112 bn and a further +17%/6% in 2021/22.

To monitor the spending potential of the hyperscalers, we also consider their capital intensity (capex/sales) and spending as a percentage of their operating cash flow for a measure of their historical reinvestment in capacity for future growth. The hyperscale companies with the rebound in capex in 2020-21 would still have between 9% and 10% capex/sales, in line with the 2020-21 range though above the 2014-17 average of 8%. On a reinvestment of operating cash flow, we project capex would be 40% of operating cash flow, in line with the 2013-20 average and sustainable for the internet and hyperscale companies to invest in compute, storage and networking to further grow the business.

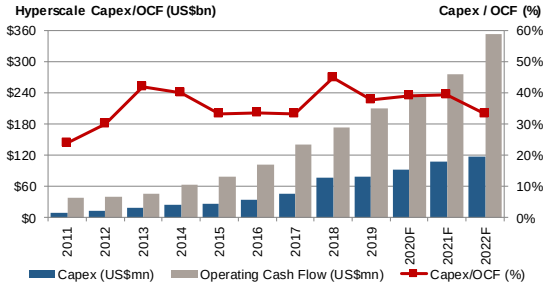
Hyperscaler capex is sustainable in-line with historical 9% capex/sales and 40% of operating cash flow reinvested in capex

Figure 71: Internet capex/sales near the historical range



Source: IDC

Figure 72: Hyperscale reinvests about 40% of OCF in capex

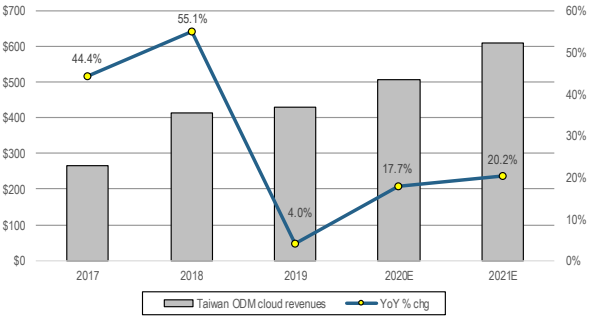


Source: Gartner

Our Taiwan cloud IT infrastructure ODMs tracker aggregates cloud sales from Quanta, Wiwynn, Inventec and Accton to gauge overall sentiment on the cloud IT infrastructure orders pull-in by the leading hyperscalers. We believe the near-term outlook remains healthy with no changes in the order in-take by hyperscalers based on our conversations; nevertheless, we would note some bottlenecks on less efficient logistics and the supply chain due to the ongoing lockdown globally, which could result in order deliveries pushed over and modest cost increases although Taiwan ODMs may be able to acquire remedies later. Overall, we forecast Taiwan ODMs to record total cloud IT infrastructure equipment sales of NT$507.2/609.8 bn in 2020/21E for 18%/20% YoY growth.

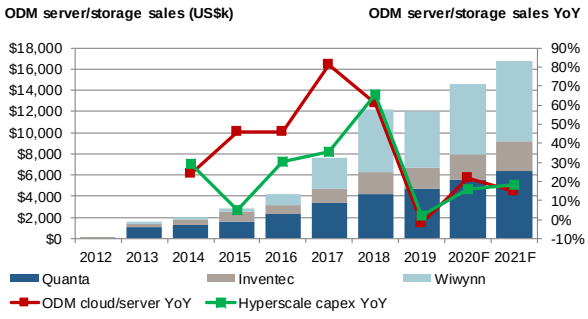
Figure 73: Taiwan cloud IT infrastructure ODMs cloud sales rebounding to double-digit % growth YoY in 2020/21E

Sales in NT$ bn (L-axis) and YoY % change (R-axis)



Note 1): Taiwan Cloud IT infrastructure ODMs tracker include cloud sales from Quanta, Wiwynn, Inventec, MiTAC (MCT) and Accton; 2) MiTAC's MCT sales includes both cloud and enterprise. Source: Company data, Credit Suisse estimates

Figure 74: ODM server/storage sales track closely with hyperscale capex growth



Source: Company data, Credit Suisse estimates

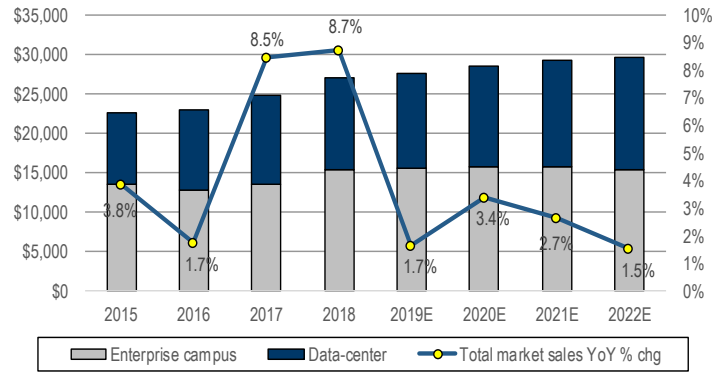
Switch market growth mild, but whitebox rising

According to IHS, global switch units are expected to deliver a 2.5% CAGR over 2019-22, reaching US$29.7 bn and representing nearly 20% of global IT infrastructure hardware spending. Notably, data centres are also the segment in which whitebox players enjoy premium growth on continued share gains, given cloud operators' focus on optimising the total cost of ownership (TCO) in terms of both opex and capex, as they leverage harder on whitebox ODM

Overall switching units growing at a 2.5% CAGR to US$29.7 bn

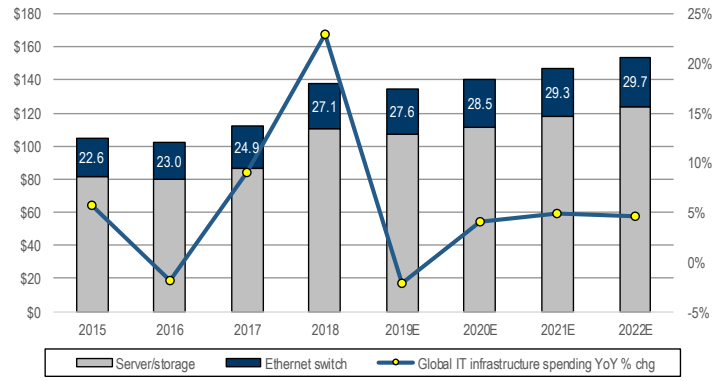
hardware design know-how and manufacturing capabilities, combining it with their in-house solution offerings.

Figure 75: Global switching sales projected to see 2.5% CAGR over 2019-22, led by data-centre demand
Sales in US$ mn (L-axis) and YoY % change (R-axis)



Source: Company data, IHS, Credit Suisse

Figure 76: Networking switch sales representing 19-20% of global infrastructure hardware spending
Sales in US$ mn (L-axis) and YoY % change (R-axis)



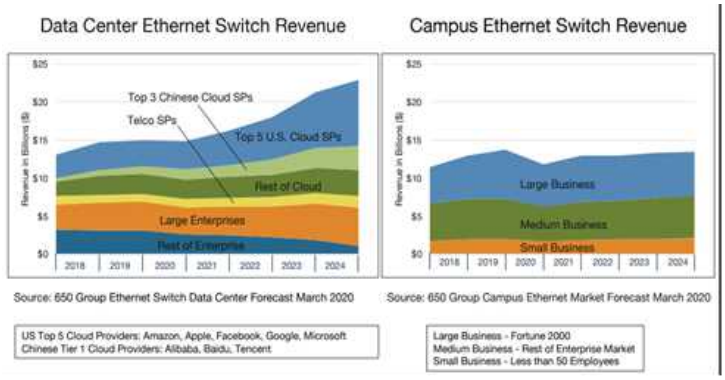
Source: Company data, IDC, IHS, Credit Suisse

Data-centre switching outpacing enterprise switching

Relative to the 2.5% switch CAGR, data-centre switching is a faster growing segment led by the top cloud service providers in the US and China, with the rest of cloud and enterprise relatively flat. The 650 Group projects these cloud service providers to drive data-centre switching to deliver an 11% CAGR from US$15 bn in 2020 to US$23 bn by 2024. Key drivers behind the upgrade include virtualisation, cloud, big data, collaboration and cost savings from the reduction of cabling and configuration complexity. The 25Gbps, 50Gbps and 100Gbps markets are growing rapidly being pushed by the hyperscalers (MSFT, Google, etc.) and switch chipmakers (AVGO, MLNX, CAVM) owing to better thermals and economics than the current 40Gbps and 100Gbps adapters and switches. By 2024, 400Gbps is expected to have carved out about 50% of the data-centre switching market, driving good upgrade demand.

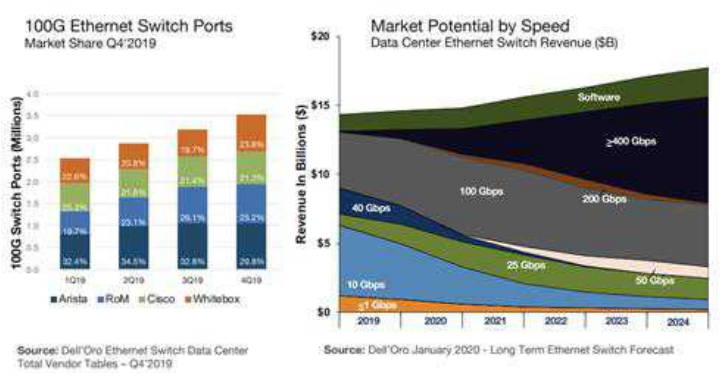
Data-centre switching growing faster at an 11% CAGR to US$23 bn by 2024

Figure 77: Cloud service providers driving Ethernet switching


Data Center Ethernet Switch Revenue
Campus Ethernet Switch Revenue
Top 3 Chinese Cloud SPs
Telco SPs
Top 5 U.S. Cloud SPs
Rest of Cloud
Large Enterprises
Rest of Enterprise
Large Business
Medium Business
Small Business
Source: 650 Group Ethernet Switch Data Center Forecast March 2020
Source: 650 Group Campus Ethernet Market Forecast March 2020
US Top 5 Cloud Providers: Amazon, Apple, Facebook, Google, Microsoft
Chinese Tier 1 Cloud Providers: Alibaba, Baidu, Tencent
Large Business - Fortune 2000
Medium Business - Rest of Enterprise Market
Small Business - Less than 50 Employees

Source: 650 Group, Arista Networks

Figure 78: Ethernet switch driven by whitebox / higher speeds



Source: Dell'Oro, Arista Networks, Sales in US$ bn and % of mix

CS analyst Sami Badri's overall networking forecast is in line with this with growth maintaining a 2.8% CAGR from 2018-23, switching growth at 2%, routing at 3% and WLAN at 8%. We believe the key area of growth outperformance is mainly speed migration (from 100GbE to 400GbE) on top of the total port unit growth (+8% CAGR for the same period).

Figure 79: CS projects networking to maintain a 2% sales CAGR

Networking Market ($millions)	2015	2016	2017	2018	2019E	2020E	2021E	2022E	2023E	CAGR '14-'18	CAGR '18-'23
Switching											
Carrier Switching	2,511	2,372	2,413	2,178	2,136	2,088	1,999	1,905	1,816	(4.8%)	(3.6%)
Data Center Switching	8,999	10,123	11,454	11,774	11,978	12,669	13,558	14,223	14,628	8.8%	4.4%
50GB & Below	8,840	9,298	8,989	7,799	6,746	6,008	5,238	4,689	4,222	(1.6%)	(11.5%)
100GB & Above	159	825	2,464	3,975	5,232	6,661	8,320	9,534	10,405	167.1%	21.2%
Campus Switching	13,594	12,862	13,487	15,342	15,155	15,255	14,982	15,098	15,111	3.5%	(0.3%)
Total Switching	**25,105**	**25,357**	**27,353**	**29,294**	**29,269**	**30,012**	**30,539**	**31,226**	**31,555**	**4.7%**	**1.5%**
Y/Y Growth	*2.8%*	*1.0%*	*7.9%*	*7.1%*	*-0.1%*	*2.5%*	*1.8%*	*2.3%*	*1.1%*		
SAN Equipment	**2,369**	**2,189**	**2,088**	**2,755**	**3,157**	**3,383**	**3,497**	**3,523**	**3,503**	**2.4%**	**4.9%**
Y/Y Growth	*-5.5%*	*-7.6%*	*-4.6%*	*32.0%*	*14.6%*	*7.2%*	*3.3%*	*0.8%*	*-0.6%*		
Application Delivery Controllers											
Hardware	1,581	1,462	1,348	1,214	1,065	954	844	735	640	(7.6%)	(12.0%)
Virtual	412	500	515	577	650	687	723	755	774	20.6%	6.0%
Total ADC Market	**1,993**	**1,962**	**1,862**	**1,791**	**1,715**	**1,641**	**1,567**	**1,490**	**1,413**	**(2.0%)**	**(4.6%)**
Y/Y Growth	*2.7%*	*-1.6%*	*-5.1%*	*-3.8%*	*-4.3%*	*-4.3%*	*-4.5%*	*-4.9%*	*-5.1%*		
Routing											
Service Provider Routing	12,746	12,927	13,171	12,770	12,884	13,039	13,179	13,325	13,465	0.3%	1.1%
Core Routers	2,850	3,289	3,471	3,564	3,561	3,690	3,823	3,950	4,082	7.9%	2.8%
Edge Routers	9,896	9,638	9,700	9,206	9,323	9,349	9,357	9,374	9,383	(2.0%)	0.4%
Enterprise Routing	3,033	3,046	2,920	2,873	3,288	3,285	3,255	3,220	3,169	(0.5%)	2.0%
Optical Networking	12,923	13,887	14,496	14,649	15,448	16,181	16,830	17,591	18,428	3.7%	4.7%
Total Routing Market	**28,701**	**29,861**	**30,587**	**30,291**	**31,620**	**32,504**	**33,264**	**34,135**	**35,062**	**1.8%**	**3.0%**
Y/Y Growth	*1.6%*	*4.0%*	*2.4%*	*-1.0%*	*4.4%*	*2.8%*	*2.3%*	*2.6%*	*2.7%*		
WLAN											
Access Points	4,014	4,339	4,654	5,016	5,156	5,855	6,548	7,216	7,840	8.0%	9.3%
Controllers	971	953	1,207	1,383	1,421	1,263	1,258	1,310	1,405	6.4%	0.3%
Total WLAN Market	**4,986**	**5,292**	**5,862**	**6,399**	**6,577**	**7,117**	**7,806**	**8,525**	**9,245**	**7.6%**	**7.6%**
Y/Y Growth	*4.5%*	*6.1%*	*10.8%*	*9.2%*	*2.8%*	*8.2%*	*9.7%*	*9.2%*	*8.4%*		
Overall Networking Market	**63,154**	**64,660**	**67,752**	**70,531**	**72,339**	**74,658**	**76,672**	**78,900**	**80,778**	**3.3%**	**2.8%**
Y/Y Growth	*2.1%*	*2.4%*	*4.8%*	*4.1%*	*2.6%*	*3.2%*	*2.7%*	*2.9%*	*2.4%*		

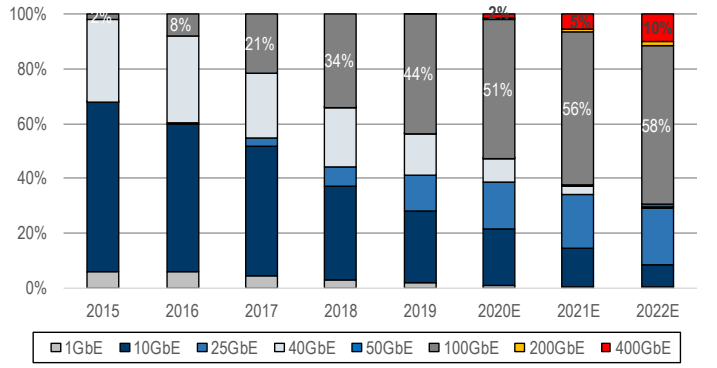
Source: Credit Suisse estimates, IHS Markit

400Gbe pricing still at a 3-4x premium but starting to ramp in 2H20 toward 10% of the mix in 2022

According to IHS, it noted that the 400GbE networking switch began shipments from 2019 and is expected to grow to represent 4% and more than 10% of total data-centre switch revenue in 2020 and 2021, respectively. Comparatively, the non-data-centre segment largely hinges on 1/10 GbE speed ports for enterprise, telco and campus networking applications, which have been facing greater pricing pressure, but would shift towards 10/25GbE in the next few years.

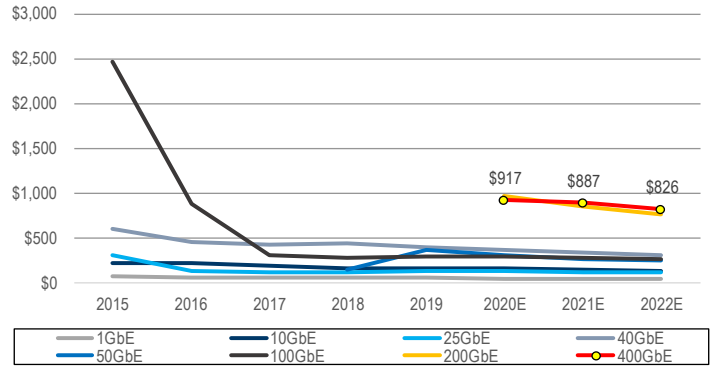
Overall, IHS expects the ASP for 400GbE speed ports to be 3-4x that of the data-centre directed switch blended ASP in 2020, before it narrows to 3x in 2022, as the cost for chipsets and other components comes down. Accton started some shipments of 400GbE switches to Facebook in 2Q19, accounting for ~10% of sales in 2019E. We believe one of its hyperscale customers should also shift to 400GbE from 2H20 and overall 400GbE could account for 12-13% of total sales in 2020E.

Figure 80: 400GbE adoption began from 2019, representing 4% of total sales in 2020 and more than 10% of sales in 2021
% of total sales



Source: Company data, IHS, Credit Suisse

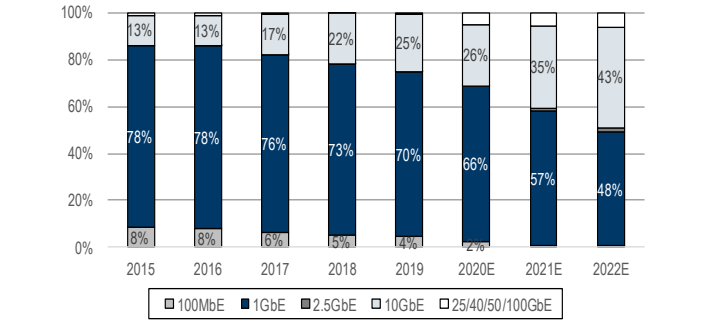
Figure 81: The latest wave of 400GbE port migration is a key driver of data-centre sales growth outperformance
ASP in US$



Source: Company data, IHS, Credit Suisse

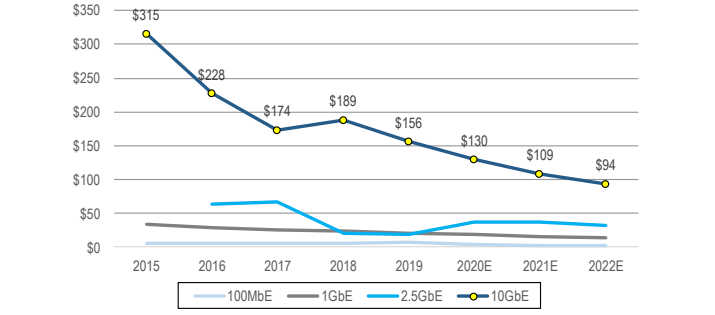
Despite 400GbE switch ports being expected to start proliferating in 2020, we believe the mainstream speed ports currently in data centres will remain on 100GbE ports, along with the 10GbE, despite the relative importance of 10GbE gradually declining, as the market continues to transit to higher speed ports to support expanding applications. In addition, new speed ports, including 25GbE, are also seeing rising adoption on 10GbE migration. We expect 100GbE switch ports to remain the mainstream port, supported by demand from high-end data centres and hyperscale cloud providers, and expect 400GbE ports to further proliferate in 2020-22.

Figure 82: 10GbE ports see increasing penetration vs predominant 1GbE ports in the enterprise campus segment
% of total market sales



Source: Company data, IHS, Credit Suisse

Figure 83: Continued speed port migration towards 10GbE helps offset the continued ASP erosion in enterprise campus
ASP in US$



Source: Company data, IHS, Credit Suisse

In the non-data-centre enterprise campus segment, IHS forecasts overall port units for switches to deliver a +1% CAGR over 2019-22, driven by growing IoT end-points, along with digital transformation, and consistent with its 5.9% CAGR over 2014-19. We believe the incremental demand from the new Wi-Fi standard upgrade to 802.11ax should also drive better 2.5GbE and 5GbE speed port adoption, along with the support from 4G/LTE backhaul. However, enterprise mobility and IoT have also led to increasing wireless penetration vs wired end-points, which may be the key offsetting factor for the segment.

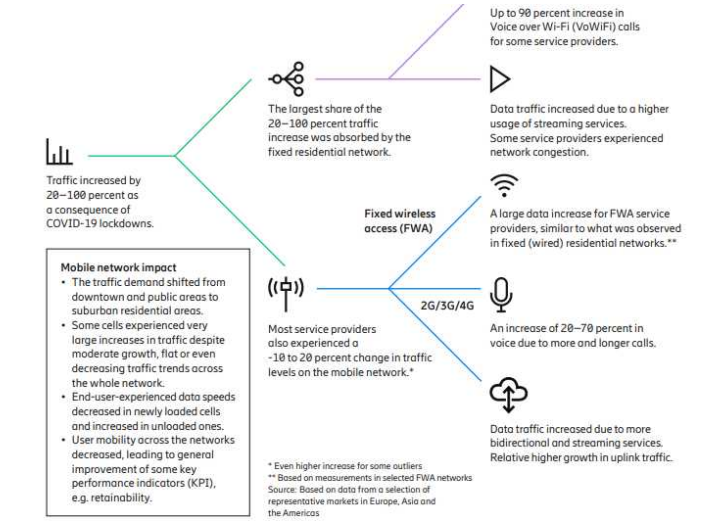
The network evolution also has new investment to support a more horizontal spine-leaf network for hyperscale data centres, where a network of servers can communicate with each other to route and handle requests from anywhere in the cloud. OEMs such as HP, Dell and JNPR are incorporating merchant silicon and actively supporting open standards.

Healthy cloud momentum despite COVID-19

We believe both CSPs (especially hyperscalers) and enterprises will continue to increase their spending on cloud IT infrastructure long term, accommodating the growing internet traffic and enhancing respective company's competitiveness through DX. In the near-term, we also see the COVID-19 global outbreak makes the cloud IT infrastructure sector a rare beneficiary, given the increasing trend on work-from-home, stay-at-home, and distance education, amid the shelter-in-place orders globally.

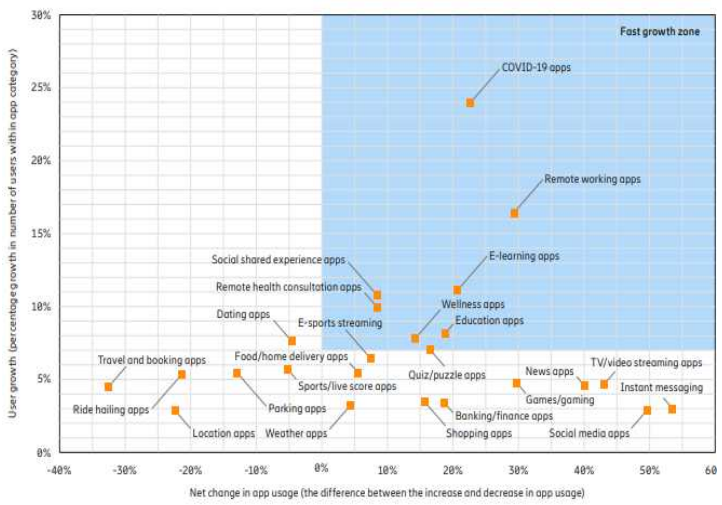
Some of the comments immediately after the outbreak were seeing surges in activity. Specifically, Microsoft wrote on its official Azure blog on 28 March that it saw increasing cloud activities by 775% in Italy in a one-month period amid lock-down; Verizon also pointed out first time in mid-Mar that it saw surging online activities in gaming (+75% week-over-week), VPN (+34% week-over-week), web traffic (+20% week-over-week) and video (+12% week-over-week) during the peak hour usage in the US; Amazon has recently kicked-off a second round of recruits by 75,000 people, after the prior round of 100,000 recruits in March, as it sees accelerating activities for online sales and AWS cloud services amid the outbreak.

Figure 84: COVID-19 led to higher data traffic over broadband


Traffic increased by 20–100 percent as a consequence of COVID-19 lockdowns.
Mobile network impact
• The traffic demand shifted from downtown and public areas to suburban residential areas.
• Some cells experienced very large increases in traffic despite moderate growth, flat or even decreasing traffic trends across the whole network.
• End-user-experienced data speeds decreased in newly loaded cells and increased in unloaded ones.
• User mobility across the networks decreased, leading to general improvement of some key performance indicators (KPI), e.g. retainability.
The largest share of the 20–100 percent traffic increase was absorbed by the fixed residential network.
Up to 90 percent increase in Voice over Wi-Fi (VoWiFi) calls for some service providers.
Data traffic increased due to a higher usage of streaming services. Some service providers experienced network congestion.
Fixed wireless access (FWA)
A large data increase for FWA service providers, similar to what was observed in fixed (wired) residential networks.**
2G/3G/4G
Most service providers also experienced a -10 to 20 percent change in traffic levels on the mobile network.*
An increase of 20–70 percent in voice due to more and longer calls.
Data traffic increased due to more bidirectional and streaming services. Relative higher growth in uplink traffic.
* Even higher increase for some outliers
** Based on measurements in selected FWA networks
Source: Based on data from a selection of representative markets in Europe, Asia and the Americas

Source: Ericsson Mobility Report, June 2020

Figure 85: COVID-19 drove growth in e-learning/remote work



Source: Ericsson Mobility Report, June 2020

Surge in activity supports 2Q20-3Q20, 4Q20/1Q21 could pause ahead of Ice Lake

The surge of activity drove a strong recovery in server order activity in 2Q20 to Taiwan cloud IT infrastructure ODMs as key hyperscalers expanded capacities to support the surging cloud workflow. ODM sales to cloud service providers and hyperscalers recovered +32% QoQ and +19% YoY in 2Q20. Our checks with the supply chain suggest build rates remain healthy even following the strength into 3Q20, with our estimates up +13% QoQ for peak season build-up for US hyperscalers and China activity remains decent with some builds to support Singles Day capacity and still healthy online activity despite the COVID-19 situation stabilising in China.

We expect a 1-2 quarter digestion in server builds late in the year, modelling -2% QoQ ODM sales in 4Q20 followed by a -9% QoQ decline in 1Q21 due both to traditional seasonal adjustments at year-end and capacity digestion ahead of Intel's new Ice Lake platform refresh. We believe cloud makers will begin to adopt Ice Lake in 2Q21 and accelerate that in 2H21, with enterprise adoption starting one quarter after in 3Q21 due to their longer qualification time.

ODM shipments may flatten in 4Q20 but would still grow +14% YoY in 2020

Figure 86: Cloud builds and IC shipments strong in 2020/21 even with a late year pause

NT$bn/BMC (mn)	1Q20	2Q20	3Q20E	4Q20E	1Q21E	2Q21E	3Q21E	4Q21E	2017	2018	2019	2020E	2021E
Inventec	12.4	20.0	22.0	18.0	16.0	22.0	24.0	22.0	43.0	63.0	63.1	72.4	84.0
Quanta	35.0	37.9	47.6	47.6	42.0	43.2	54.7	55.2	102.2	125.1	144.5	168.0	195.1
Wiwynn	35.1	52.1	55.3	56.6	53.6	64.8	67.6	65.6	85.7	181.1	163.6	199.1	251.6
MiTAC	6.8	9.0	9.2	8.8	8.5	10.6	11.4	10.8	40.6	22.0	26.6	33.8	41.4
Accton	5.5	6.1	7.0	7.8	6.6	7.9	9.3	8.3	14.2	18.5	25.9	26.3	32.1
Total	**94.8**	**125.0**	**141.1**	**138.7**	**126.7**	**148.5**	**167.0**	**161.9**	**285.7**	**409.7**	**423.7**	**499.6**	**604.2**
QoQ	***-22%***	***32%***	***13%***	***-2%***	***-9%***	***17%***	***12%***	***-3%***					
YoY	***4%***	***19%***	***34%***	***14%***	***34%***	***19%***	***18%***	***17%***	***54%***	***43%***	***3%***	***18%***	***21%***
ASpeed BMC units	**2.7**	**3.3**	**3.1**	**2.6**	**2.9**	**3.3**	**3.5**	**3.3**	**6.8**	**7.9**	**8.6**	**11.6**	**13.1**
QoQ	***4%***	***24%***	***-8%***	***-17%***	***15%***	***13%***	***6%***	***-6%***					
YoY	***44%***	***89%***	***27%***	***-1%***	***10%***	***0%***	***15%***	***30%***	***48%***	***16%***	***9%***	***35%***	***13%***

Source: Company data, Credit Suisse estimates

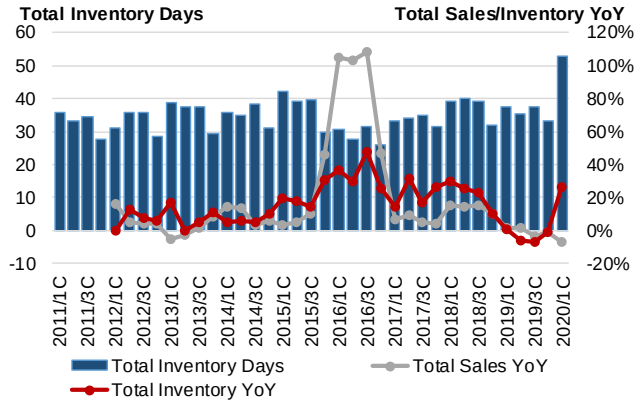
We have witnessed a component inventory build in 1H20 as hardware suppliers carry buffer to manage for constraints and place rush orders for surging demand to support higher COVID-19 traffic. We expect inventory to come down after the 2H20 digestion, setting up a rebuild by 1Q21, a quarter ahead of the ODMs, and estimate a +15% QoQ rebound for Aspeed.

Figure 87: Hardware inventory increased 20 days exiting 1Q20

Inventory Days	2019/1C	2019/2C	2019/3C	2019/4C	2020/1C
Dell	20	18	19	19	22
HP	41	42	45	50	78
Lenovo	31	31	30	30	52
Inspur	75	68	68	68	115
Sugon	118	155	132	164	190
Inventec	38	34	35	28	59
Quanta	65	59	61	40	76
Wiwynn	42	36	59	35	74
Supermicro	110	85	94	88	124
Total Inventory Days	**38**	**35**	**37**	**33**	**53**
Total Sales YoY	**2%**	**2%**	**-4%**	**-1%**	**-7%**
Total Inventory YoY	**0%**	**-6%**	**-7%**	**-1%**	**26%**

Source: Company data, Credit Suisse estimates

Figure 88: Inventory higher following lower 1Q20 sales

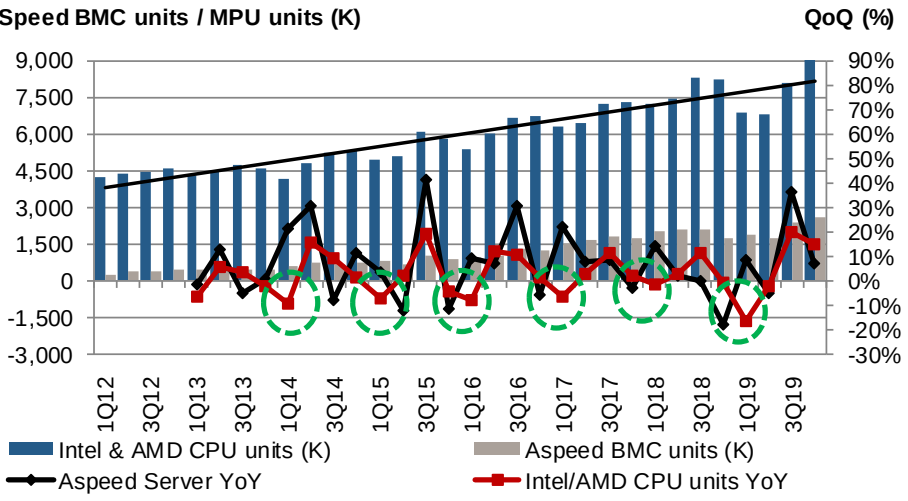


Source: Company data, Credit Suisse estimates

For some suppliers into the data centre, we expect a slowdown earlier following higher 1H20 volumes and inventory build-up, modeling Aspeed (70% share of server units) BMC shipments -8% QoQ in 3Q20 and -17% in 4Q20. The company and other semiconductor suppliers outshipped the supply chain in 1H20, with Aspeed units up 66% albeit from a depressed 1H19 base due to the trade war and hangover from the prior strong cycle in 2017/18.

The data centre cycle typically builds for 5-6 quarters and then corrects for 1-2 quarters

Figure 89: Server IC components typically build for 5-6 quarters, followed by 1-2 quarter capacity and inventory adjustments



Source: Company data, Mercury CPU Units, Credit Suisse estimates

The inventory correction is normal for the server market, which has had six mild digestion periods since 2013 amid a continued uptrend in market volumes. Even with the correction late in the year, our ODM cloud sales are still forecast up 14% YoY and Aspeed BMC units would be up 35% YoY. We expect units to recover coming out of a late 2020 slowdown on new platform launches and to support the on-going growth in hosted and Internet service revenue.

Intel Ice Lake platform ramps in 1H21 should stimulate another round of purchases

The more major CPU platform refreshes should be a good catalyst for another wave of upgrades. Intel's Ice Lake finally moves its server platform to 10nm for better power performance, adds in higher speed connections for data transfer to the processor through PCIe 4.0 and support for higher core count CPUs for the high-end of the market. In 4Q21, Intel will follow with a new Eagle Stream Platform and Sapphire Rapids chipsets adding in support for PCIe 5.0 and higher performance DDR 5 memory.

Figure 90: Intel Ice Lake and Sapphire Rapids to drive server builds in 2021

Family Branding	Skylake-SP	Cascade Lake-SP/AP	Cooper Lake-SP/AP	Ice Lake-SP	Sapphire Rapids	Granite Rapids
Process Node	**14nm+**	**14nm++**	**14nm++**	**10nm+**	**10nm++**	**7nm**
Platform Name	**Intel Purley**	**Intel Purley**	**Intel Whitley**	**Intel Whitley**	**Intel Eagle Stream**	**Intel Eagle Stream**
MCP (Multi-Chip Package)	No	Yes	Yes	Yes	TBD	TBD
Socket	LGA 3647	LGA 3647 BGA 5903	LGA 4189 BGA 5903	LGA 4189	TBD	TBD
Max Core Count	Up To 28	Up To 28 Up To 48	Up To 28 Up To 48	Up To 38	TBD	TBD
Max Thread Count	Up To 56	Up To 56 Up To 96	Up To 56 Up To 96	Up To 76	TBD	TBD
Max L3 Cache	38.5 MB L3	38.5 MB L3 66 MB L3	TBA	TBA	TBD	TBD
Memory Support	DDR4-2666 6-Channel	DDR4-2933 6-Channel DDR4 2933 12-Channel	Up To 8-Channel DDR4	8-Channel DDR4	8-Channel DDR5	8-Channel DDR5
PCIe Gen Support	PCIe 3.0	PCIe 3.0	PCIe 3.0	PCIe 4.0	PCIe 5.0	PCIe 5.0
TDP Range	140W-205W	165W-205W	TBD	Up To 230W	TBD	TBD
3D Xpoint Optane DIMM	N/A	Apache Pass	Barlow Pass	Barlow Pass	Crow Pass	Donahue Pass
Competition	**AMD EPYC Naples 14nm**	**AMD EPYC Rome 7nm**	**AMD EPYC Rome 7nm**	**AMD EPYC Milan 7nm+**	**AMD Next-Gen EPYC (Post Milan)**	**AMD Next-Gen EPYC (Post Milan)**
Launch	**2017**	**2018**	**2019**	**Late 2020**	**Late 2021**	**2022**

Source: Company data, Credit Suisse

AMD is also continuing to upgrade platforms, with Zen 3 ramping up in 2H20 using TSMC 7nm, followed by Zen 4 on TSMC 5nm and also upgrading to PCIe 5.0 and DDR 5 support in 2021.

Figure 91: AMD roadmap—refresh to Zen 4 on 5nm in 2021

Architecture	Zen 1	Zen 1 / Zen+	Zen 2 / Zen+	Zen 3	Zen 4
Process Node	14nm	14nm / 12nm	7nm	7nm	5nm
PCIe support	PCIe 3.0	PCIe 3.0	PCIe 4.0	PCIe 4.0	PCIe 5.0
Memory	DDR4	DDR4	DDR4	DDR4	DDR5
High End Server (SP3)	**EPYC Naples**	**EPYC Naples**	**EPYC Rome**	**EPYC Milan**	**EPYC Genoa**
Max Server Cores / Threads	32/64	32/64	64/128	64/128	TBD
Clock rate	Up to 3.2GHz	Up to 3.2GHz	Up to 3.4GHz	TBD	TBD
PC - Ryzen Family	**Ryzen 1000 Series**	**Ryzen 2000 Series**	**Ryzen 3000 Series**	**Ryzen 4000 Series**	**Ryzen 5000 Series**
High End Desktop (TR4)	Ryzen Threadripper 1000 Series	Ryzen Threadripper 2000 Series	Ryzen Threadripper 3000 Series (Castle Peak)	Ryzen Threadripper 4000 Series (Genesis Peak)	Ryzen Threadripper 5000 Series
Max HEDT Cores / Threads	16/32	32/64	64/128	TBD	TBD
Mainstream Desktop (AM4)	Ryzen 1000 Series (Summit Ridge)	Ryzen 2000 Series (Pinnacle Ridge)	Ryzen 3000 Series (Matisse)	Ryzen 4000 Series (Vermeer)	Ryzen 5000 Series
Max Mainstream Cores / Threads	16-Aug	16-Aug	16/32	TBD	TBD
Budget APU (AM4)	N/A	Ryzen 2000 Series (Raven Ridge)	Ryzen 3000 Series (Picasso 12nm	Ryzen 4000 Series (Renior Zen 2)	Ryzen 5000 Series
Year	**2017**	**2018**	**2019**	**2H20**	**2021**

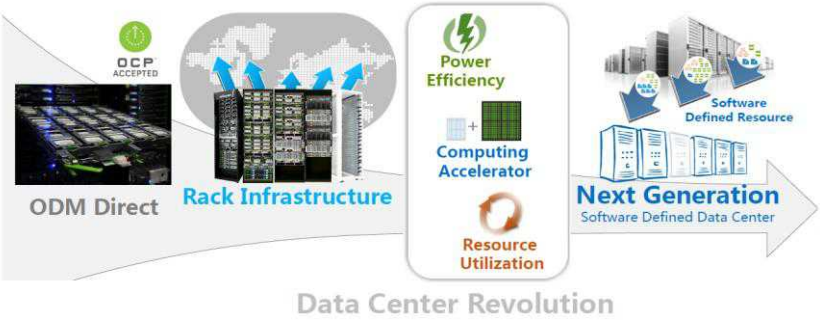
Source: Company data, Credit Suisse estimates

Rise of the ODM model and merchant silicon

ODM direct servers to hyperscale has grown 10x since 2011

An increasing workload shift to the cloud has in turn been driving growth for the hyperscalers. As markets increasingly shift to adopt open-sourced platforms for greater optimisation of the total cost of ownership, starting from hyperscalers to CSPs (and followed by enterprises/telcos longer-term), Taiwan cloud IT infrastructure ODMs have been key beneficiaries. ODMs' enhanced sophistication in custom hardware design, flexibility in mass-scale manufacturing and system integration and comprehensive after-market (AM) services coverage globally had helped them gain share at the hyperscalers. Combined sales made by ODM Direct in servers has increased by 10x over 2011-19 (+34.6% CAGR), driving their combined share to over 24% in 2019 (just 4% in 2011). This trend is set to continue with the rising share of hyperscalers in the overall server mix. Similarly, the Datacentre Infrastructure innovation cycle is seeing disruption, as the demand of large operators cannot be served by the traditional model, which entails OEMs' collaboration with silicon vendors. In response to the challenge, major OEMs are incorporating merchant silicon and actively supporting open standards.

Figure 92: Taiwan cloud IT infrastructure ODMs benefitting from the proliferation of open-sourced platforms making meaningful ways into global CSPs



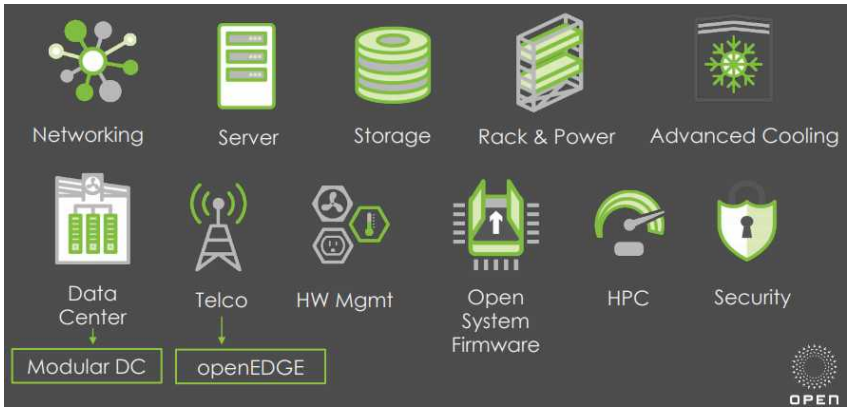
Source: Company data

Open Compute Project (OCP): A major turning point

The Open Compute Project helped enable an open platform for data centre hardware development

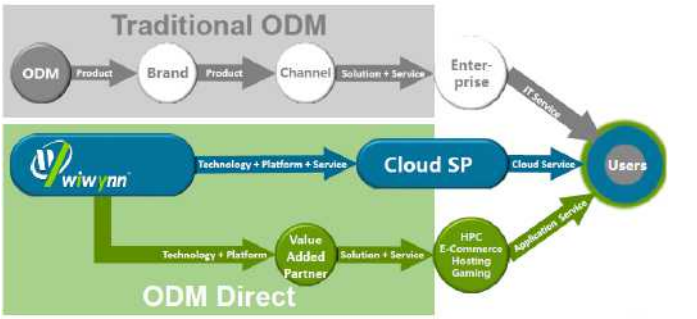
We note OCP (Open Compute Project) marked an important milestone for the ODM Direct business model to take-off in the past decade. Specifically, OCP was founded by Facebook in 2011 along with members including Intel, Microsoft, Rackspace, Goldman Sachs, and Sun Founder and Google early investor, Andy Bechtolsheim, as they aim to break the blackbox proprietary IT infrastructure to achieve greater choice, customisation, and cost savings (both capex and opex) based on an open-source platform where members can collaborate and share innovation and creativity, improving the efficiency of the data flowing worldwide.

Figure 93: Key areas of focus by OCP for removal of blackbox proprietary architecture



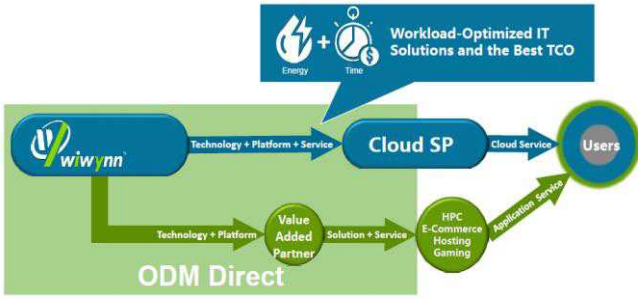
Source: OCP

Figure 94: Traditional business model with ODMs shipping indirectly to enterprises via brands or system integrators



Source: Company data

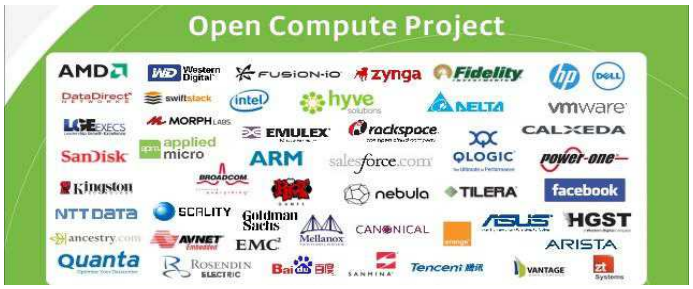
Figure 95: ODM Direct—new business model enabled first by hyperscalers and CSPs



Source: Company data

The OCP take-off has transformed the hardware market, shifting from enterprises going to OEMs for IT equipment manufactured and/or designed by ODMs, to direct ODM engagement (i.e. ODM Direct) first from hyperscalers and CSPs. We are starting to see telcos and large enterprises follow, given their ability for greater customisation to achieve better workload optimisation and improving TCOs. We believe Taiwan cloud IT infrastructure ODMs especially Quanta and Wiwynn are the beneficiaries in the proliferation of ODM Direct in server and enterprise storages, while Accton is the beneficiary of ODM Direct growth in Ethernet switch.

Figure 96: Key participants in the OCP



Source: OCP

Figure 97: OCP products recognition programme overview

Products that comply 100% with an OCP approved specification and the design files are open sourced and available.
OCP ACCEPTED
Products that comply 100% with an OCP approved specification and are available from a Gold, Silver or Platinum member of OCP
OCP INSPIRED
Worldwide Delivery, Service, Support Network
OPEN Compute Project
SOLUTION PROVIDER

Source: OCP

Importantly, Taiwan ODMs have been the important supporters for the proliferation of the OCP, with OCP Taiwan (OCPT) as one of the first regional communities within OCP founded in May-2013, alongside other regional communities today established in Japan, China, the EU, India and Korea. Notably, Taiwan's certified OCP solution providers currently make up 1/3 of the global solution providers, while 64% of the total OCP contribution projects (71% of OCP Accepted and 48% of OCP Inspired) have been contributed by key Taiwan ODM led by Accton's Edgecore in networking, as well as Wiwynn and Quanta's QCT in server/storages.

Taiwan ODM suppliers have contributed 64% of the OCP contribution projects

Figure 98: Key Taiwan cloud IT infrastructure ODM overview

Source: OCP

Figure 99: Taiwan ODMs leading overall OCP contributions

Company	Contribution projects	Accepted	Inspired	Total
Edgecore (Accton)	Network	32	0	32
Wiwynn	Server, Storage	21	2	23
QCT (Quanta)	Server	7	13	20
Delta	Network	1	5	6
MiTAC	Rack & Power, Mezzaine	0	5	5
Total # OCPT Product +Design Contibutions		**61**	**25**	**86**
% of OCPT contribution		**71%**	**48%**	**64%**
Total # in OCP Community		**86**	**52**	**135**

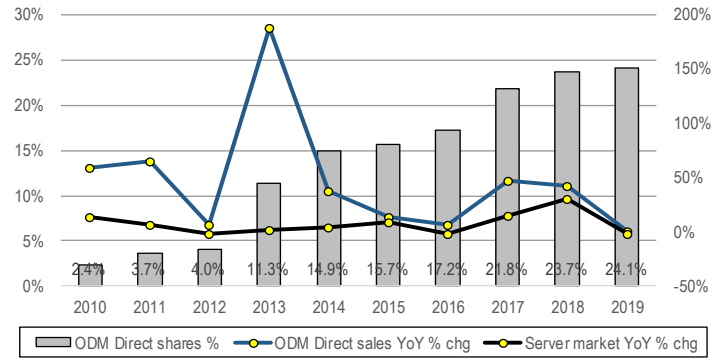
Source: OCP, Credit Suisse

ODM Direct key beneficiaries from the OCP rollout

We believe Taiwan cloud IT infrastructure ODMs have been key beneficiaries from the proliferation of ODM Direct by providing high quality open-sourced hardware solutions with greater customisation for workload optimisation and also more competitive pricing preferable by the hyperscalers and CSPs. Specifically, the combined sales made by ODM Direct in servers increased materially by over ten-fold over 2011-19 or +34.6% CAGR, driving their combined share to over 24% in 2019, vs less than 4% in 2011, while the overall market grew by a 6.4% CAGR for the same period. On the flip-side, the traditional server leader HPE's sales have been declining at a 3% CAGR from 2011 to 2019, with its shares peaking in 2010 at 31% before the official rollout of OCP by Facebook, to 14% in 2019, as it intentionally retreated from the hyperscale markets due to lower profitability, while sales into Chinese customers are through its H3C JV. In the meantime, market share from Dell grew from nearly 15% in 2011 to 18% in 2019, and sales from Chinese vendors also increased. Similarly, we also see the proliferation of ODM Direct trend in enterprise storage with their combined sales increasing over ten-fold or at a +34% CAGR over 2011-19, driving the combined share to 18.6% in 2019, vs less than 3% in 2011, while the overall market saw a 5% CAGR growth for the same period.

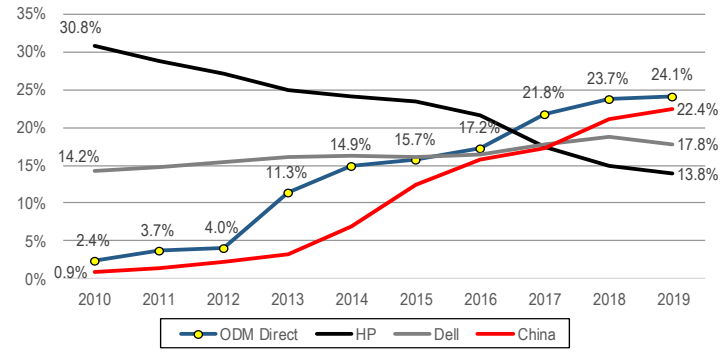
ODM direct has grown at a 35% CAGR since 2011 to increase from 4% to 24% of global servers

Figure 100: The combined ODM Direct share in server grew ten-fold from 2011 to 2019, reaching 24% share vs 4% in 2011
% of shares (L-axis) and YoY % change (R-axis)



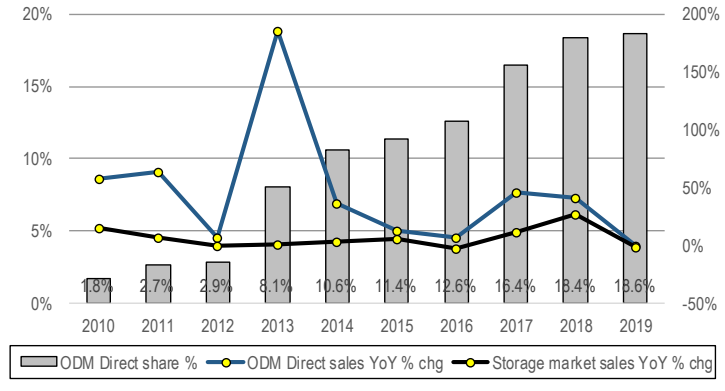
Source: Company data, IDC, Credit Suisse

Figure 101: Market leader HPE's share has been declining from peak of 31% in 2010 before the rollout of OCP, to 14% in 2019
% of market share



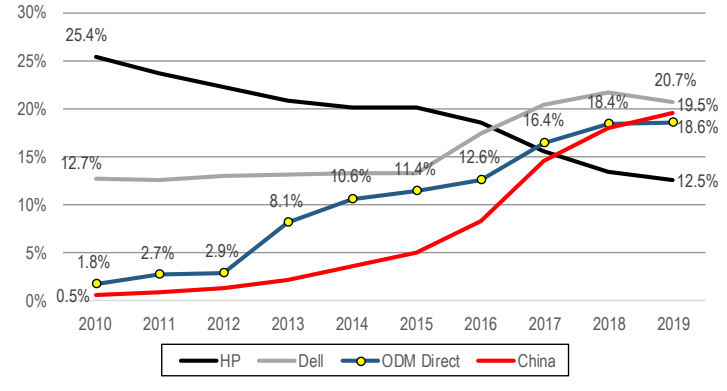
Source: Company data, IDC, Credit Suisse

Figure 102: ODM Direct share in enterprise storage also grew ten-fold from 2011 to 2019 for 18.6% shares in 2019
% of shares (L-axis) and YoY % change (R-axis)



Source: Company data, IDC, Credit Suisse

Figure 103: HPE's share also declined materially in storage from a peak of 25% in 2010 to 12.5% in 2019
% of market share

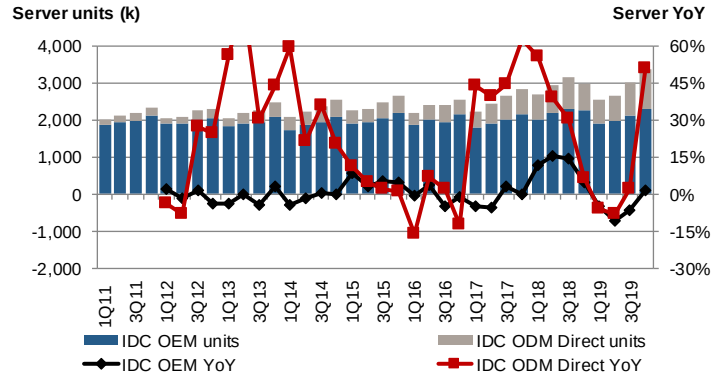


Source: Company data, IDC, Credit Suisse

ODM Direct model continually outpacing overall servers

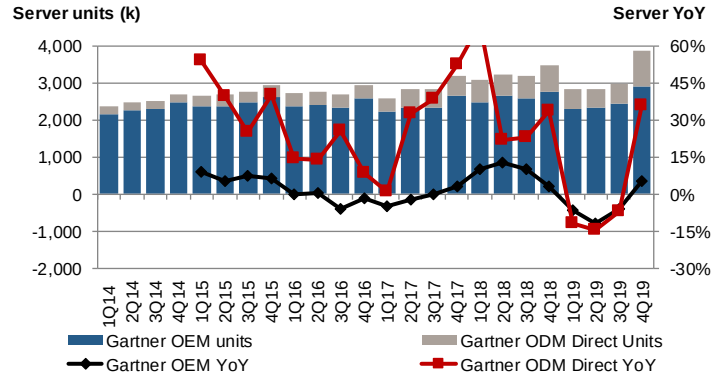
The ODM Direct model of supplying to hyperscale has been outpacing the OEM market consistently over the past decade. From 2011 to 2019, IDC estimates OEM server units grew only at a 1% CAGR to 8.3 mn units, while ODM Direct units grew at a 21% CAGR to 3.3 mn units. For Gartner, from 2014 to 2019, OEM units grew at a 2% CAGR to 10 mn units, while ODM Direct units grew at a 24% CAGR to 2.6 mn units.

Figure 104: IDC ODM Direct outpacing the server market



Source: IDC

Figure 105: Gartner ODM Direct also shows outgrowth

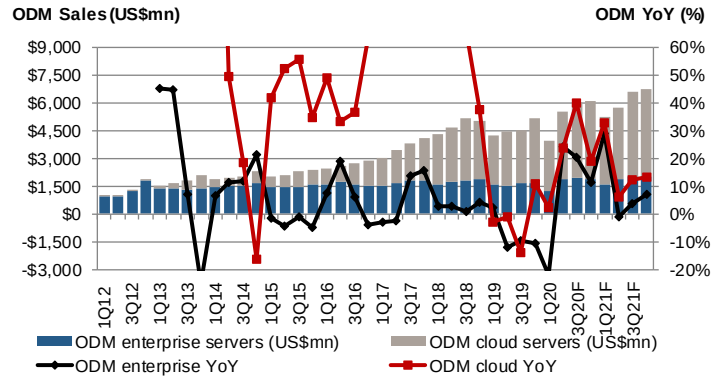


Source: Gartner

Even with the robust outgrowth reported for the ODM Direct channel, it may still be undercounting the magnitude of unit growth for this segment. For the ODMs in our tracker or Quanta, Wiwynn and Inventec, their growth in cloud servers has increased at a 40% CAGR since 2013 to US$16.8 bn, outpacing their sales growth from OEM servers at a 3% CAGR to US$7.6 bn.

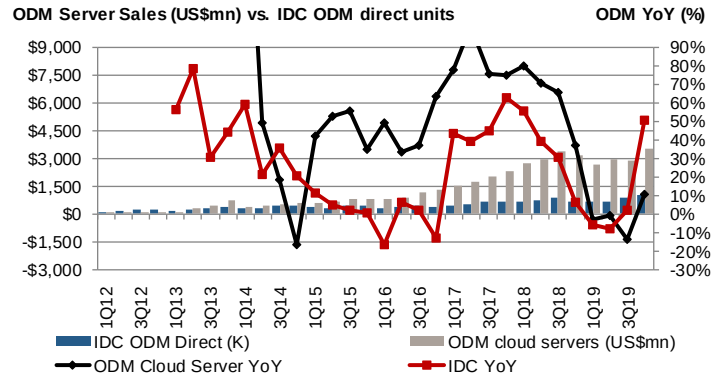
ODM vendors have grown their cloud business at a 40% CAGR since 2013, outpacing 3% server growth during that period

Figure 106: ODM cloud servers outpace enterprise servers



Source: Company Data, Credit Suisse estimates

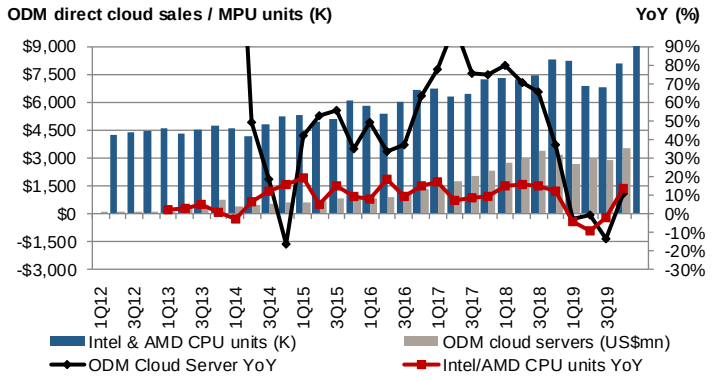
Figure 107: ODM sales growth outpacing third party estimates



Source: Gartner

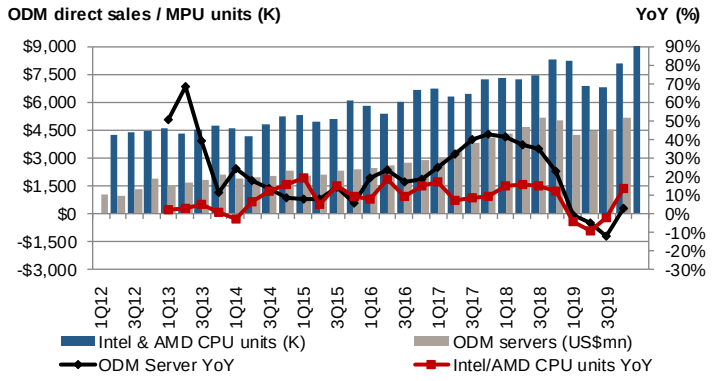
ODM growth of 40% for the cloud business and 17% for their overall revenue has also outpaced AMD and Intel server CPU units, which have grown at a 9% CAGR through the period.

Figure 108: ODM cloud servers outpace Intel/AMD CPUs



Source: Company Data, Credit Suisse estimates

Figure 109: ODM servers also outpace Intel/AMD CPUs

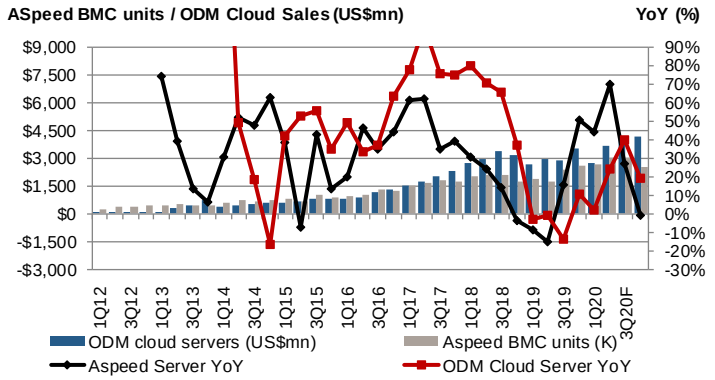


Source: Company Data, Credit Suisse estimates

Aspeed's BMC unit growth has maintained a 29% CAGR above the CPU and the overall ODM growth rate since 2013 due to the combination of share gains, acquisition of Emulux enterprise server BMC business and higher leverage to hyperscale where it supplies all but Google versus enterprise where the company still does not have a share into HP, Dell and Huawei.

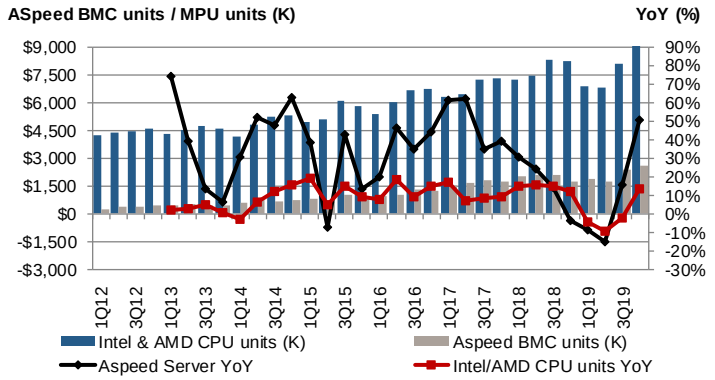
Aspeed with its BMC penetration and acquisition of Broadcom's Emulex division has grown units at a 29% CAGR since 2013

Figure 110: Aspeed BMC paces ODM cloud servers



Source: Company Data, Credit Suisse estimates

Figure 111: Aspeed BMC outpaces Intel/AMD CPUs



Source: Company Data, Credit Suisse estimates

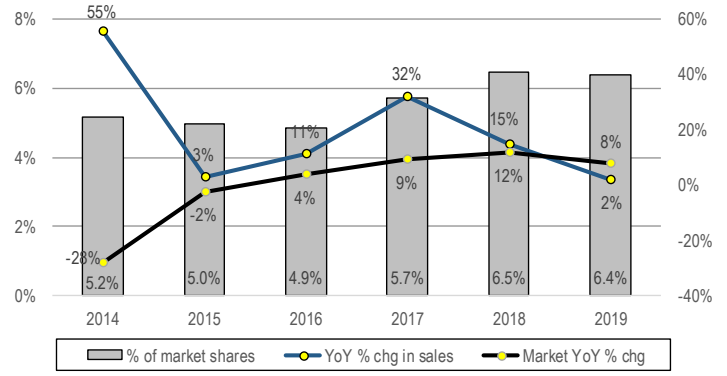
Networking switch ODM Direct grows from a low base

We believe the ODM Direct take-off in networking will follow the same trend as in the server/storage on the proliferation of OCP, as it helps enhance the cost structure on the infrastructure deployment for cloud players, despite the higher quality and security requirement.

ODM Direct has not yet seen a similar magnitude of adoption at cloud operators, given the higher barrier of requirement for security, durability and stability. However, we believe the pace of adoption should accelerate, as ODM players, especially Accton, further emulate the technology gap, while making ways more meaningfully into enterprise and telco in the 5G era in the longer term. Based on the IHS data, post the rollout of OCP, leading vendor Cisco saw the peak of its market share at 82% in 2010, similar to HPE in server. Its share halved from the peak to 41% as of 1-3Q19, with a change of +1.5% CAGR from 2011 to 2018, despite overall switch market sales seeing a 10% CAGR growth for the same period. Similarly, HPE's sales in networking switch also declined materially by a 10% CAGR from 2011 to 2018 for 2% share in 2019, vs 11% in 2011, excluding the contribution from H3C in China, while Juniper and Dell shares remain relatively flattish at 4% and 3%, respectively. Comparatively, the combined whitebox shares have grown to over 6% in 2019 (vs 5% in 2014) with growth of a 15% CAGR from 2014 to 2018, along with the rise of Huawei and Arista to 11% and 17% shares, respectively.

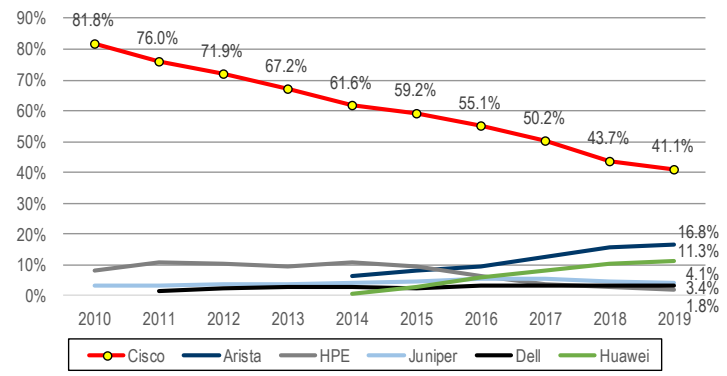
Whitebox share in switch has grown to 6% share

Figure 112: ODM adoption in cloud data-centre switch slower, vs servers, but the overall pace should accelerate
% of shares (L-axis) and YoY % change (R-axis)



Source: Company data, IHS, Credit Suisse

Figure 113: Cisco leadership also narrowed materially from peak in 2010, due to the rise of ODM Direct, Huawei and Arista
% of market share



Source: Company data, IHS, Credit Suisse

Within all the networking hardware reference design by OCP members, Accton's subsidiary Edgecore has been the most active member, contributing 14 networking hardware designs or 30% of the total 47 contributions, followed by Facebook with eight contributions (17%), with other contributors including Delta and Inventec in Taiwan, along with Mellanox, Broadcom, Dell, etc. Specifically, among the total 14 networking hardware contributions by Accton/Edgecore, 10 are related to the Ethernet switch, three are wireless access points; and the remaining one is for open cell site router. In 2018, Accton/Edgecore was also the first networking company providing 400GbE Ethernet switch reference design (i.e., AS7900-32X) to OCP, powered by Intel Broadwell CPU and Broadcom Tomahawk III, supporting Leaf/Spine deployment of 400G/100G and 32 QSFD-DD ports, each of which is capable of operating at 10G/25G/50G/100G/200G/400G modes. Comparatively, we see no other members have yet contributed the 400GbE speed for the networking switch until now.

Accton/Edgecore accounts for 30% of OCP reference designs

Figure 114: Key spec compare for Accton Edgecore contributions in 2018

	AS9700-32X	AS7326-56x	AS7726-32X
Launch	2018	2018	2018
CPU	Intel Broadwell	Intel Broadwell	Intel Broadwell
MAC	Broadcom Tomahawk III	Broadcom Tomahawk III	Broadcom Tomahawk III
Port	400G QSFP56-DD x 32	25G SFP28 x 48; 100G QSFP28 x 8; and 10G SFP+ x 2	32x 40/100G QSFP100 and 2 x 1/10G SFP+ ports (option)
FLASH	SPI FLASH 128MB x 2	16MB x 2	16MB x 2
RAM	DDR4 8GB x 2	DDR4 8GB x 2	DDR4 8GB x 2
SSD	M.2 100GB x 1, mSATA 100GB x 1 (option)	M.2 32GB x 1, mSATA SSD 32GB x 1	M.2 32GB x 1, mSATA SSD 32GB x 1

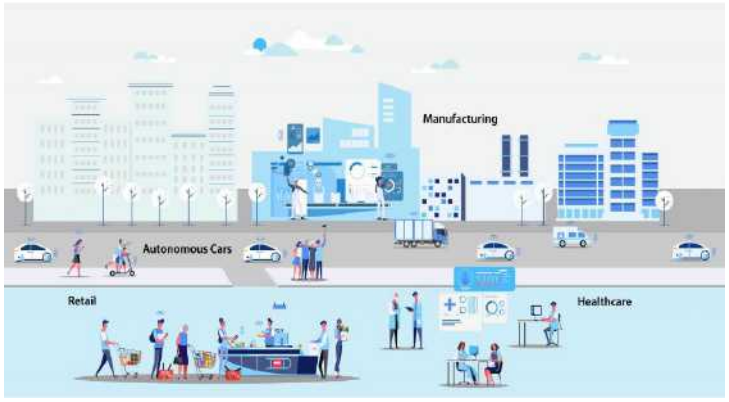
Source: Company data, OCP, Credit Suisse

New opportunities from 5G proliferation

We note the leading cloud IT infrastructure ODMs including Quanta, Wistron/Wiwynn, Hon Hai/FII, Inventec, and MiTAC started their server/storages business in early 2000 focusing on providing OEM manufacturing for traditional vendors, but all have shifted their focus to hyperscale data-centre operators or CSPs along with the OCP take-off in recent years, offering increased value-add for products with better customisation for workload optimisation at a lower TCO. We believe Taiwan ODMs are set for a second-wave of transformation from cloud to edge along with the 5G proliferation, as they capitalise on the new market opportunities with telecom operators on the open-sourced O-RAN and OCP OpenEDGE. We believe Quanta has been the front-runner in the space, while we expect other Taiwan ODMs to follow suit readying for the

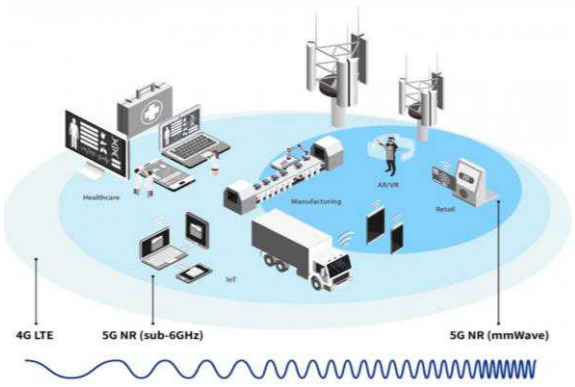
market take-off from 2021. We believe this will drive better profitability long-term, given the offering of more comprehensive 5G end-to-end hardware products and solutions to telecom operators.

Figure 115: 5G creating new business models across multiple verticals on lower-latency service delivery



Source: Wistron Wiwynn

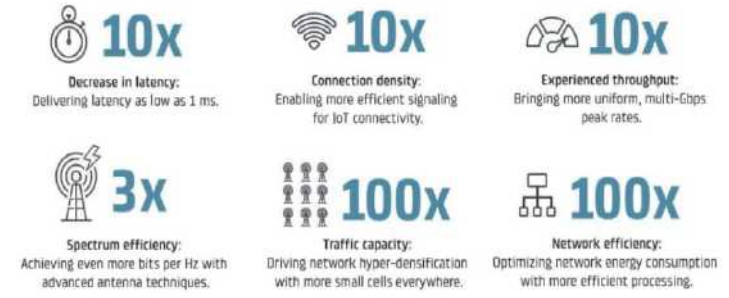
Figure 116: Telco operators need flexible architectures to support different use-case scenarios



Source: Wistron Wiwynn

5G is the next generation of cellular mobile communication technology, and is expected to provide 3x spectrum efficiency; 10x improvement in latency, connection density, and experienced throughput; and 100x traffic capacity and network efficiency, according to IDC. Since the early introduction of 5G in late 2018, the new technology has already been rolled-out globally in eight countries, including five in Europe (Switzerland, Spain, Italy, Germany, and the UK) along with the US, China, South Korea and Australia. Overall, IDC forecasts the edge IT infrastructure market size, including spending on edge server and storage (external RAID and expansion), to reach US$18.7 bn by 2022, vs US$14 bn in 2019 for a 15% CAGR growth.

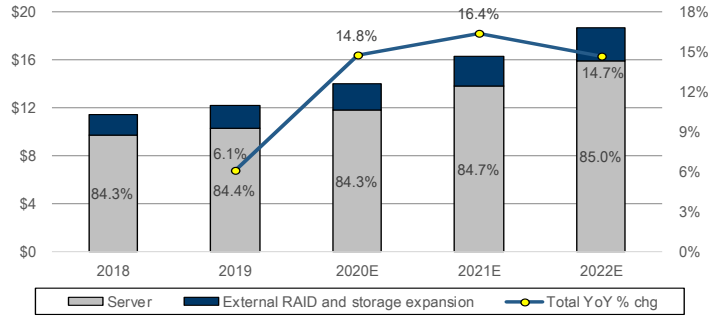
Figure 117: 5G has 10x improvements over 4G in data speeds, latency, spectrum and connection density; as well as 100x enhancement in traffic capacity and network efficiency



Source: IDC

Figure 118: Total edge IT infrastructure spending projected to grow at a 15% CAGR from 2019 to 2022

US$ bn (L-axis) and YoY % change (R-axis)



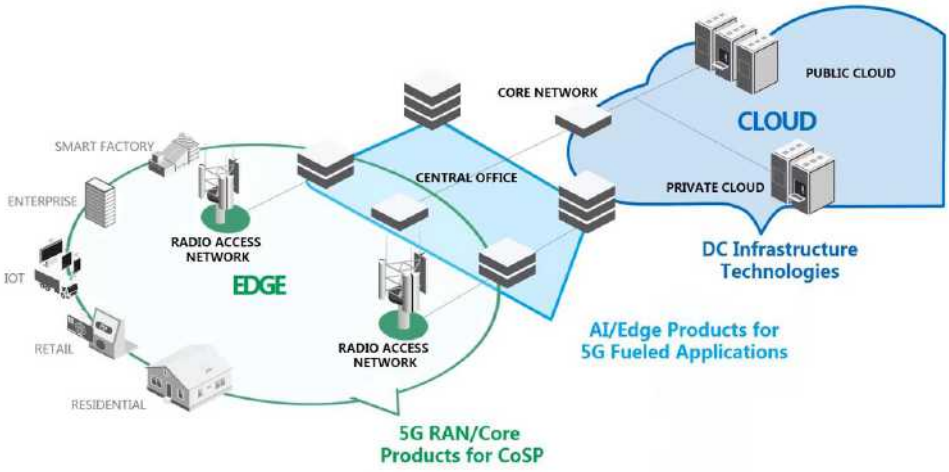
Source: Company data, IDC, Credit Suisse

5G networks offer an opportunity to offload cloud workloads to the network edge for lower latency

We believe the proliferation of 5G, complemented by new generations of fibre, cable, Wi-Fi and short-range technologies, will drive significant changes in IT infrastructure deployment, from sole focus in cloud, to greater acceleration in the establishment of the central office (CO), as well as edge at Radio Access Network (RAN), with an aim to offload cloud workload to the edge, achieving less data processing latency and lowering total costs of data transport, in our view. This will enable new business models such as artificial intelligence (AI), autonomous driving, etc., through MEC (Multi-access Edge Computing) for telecom operators. Nevertheless, we note key challenges for the traditional telcos remain on the modernisation of their legacy proprietary IT infrastructure, as more flexible deployment carried out through network slicing will become increasingly important for telcos in order to meet the demand needs from various new IoT devices and ultra-low latency demand. In addition, the higher capex spending is also a major concern, as telcos are required to build more number of base stations than it used to be in the

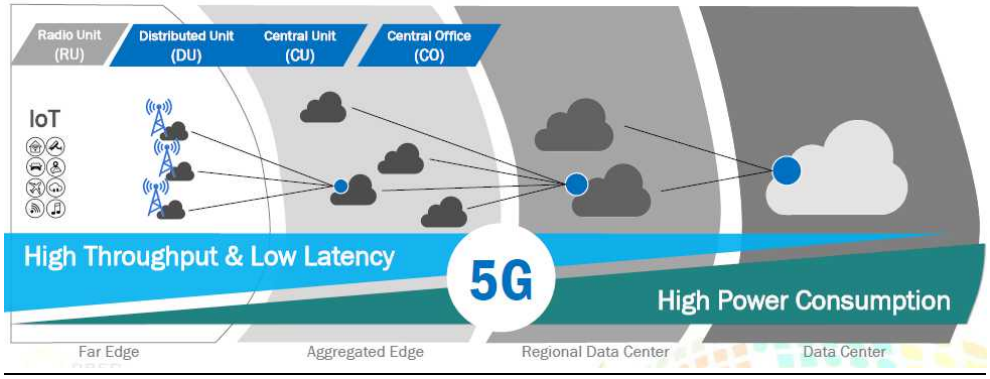
4G era to reach the same signal coverage, given the higher frequency bands used for the 5G network for both sub-6GHz and mmWave.

Figure 119: Taiwan cloud IT infrastructure ODMs set to contribute to the second-wave of transformation from cloud to edge



Source: Wistron Wiwynn

Figure 120: Enlarging opportunities for ODM Direct on vRAN proliferation allowing deployment of COTS at DU/CU and CO on virtualised network functions



Source: Wistron Wiwynn

5G networks with more open standards create a new opportunity for ODM direct hardware

We believe the proliferation of 5G will further enlarge the total addressable markets for ODM Direct hardware, capitalising the demand needs from otherwise untouchable segments with telcos, as it helps improve the TCOs for both traditional telcos while offering a more modernised architecture, as well as non-conventional players such as Rakuten to more swiftly build-up its 5G network using industry standard hardware. Specifically, virtualised radio access network (vRAN) architecture is the key approach for telcos to achieve network modernisation, as it transforms the hardware-centric network model to a software-based SDI. This provides more flexibility, agility and cost efficiency for telecom operators by breaking up the traditional base stations into three major sub-parts, including radio unit (RU), distributed unit (DU) and centralised unit (CU), allowing the deployment of commercial off-the-shelf (COTS) servers for the DU/CU on virtualised network functions. We believe the TCO for telcos can be further enhanced on this new architecture given less hardware SKUs to support, while software-defined functions can also be managed remotely with less manpower needed. Lastly, we note some of the solutions are commonly shared between CO and edge, which can also help lower TCOs on less product SKUs management.

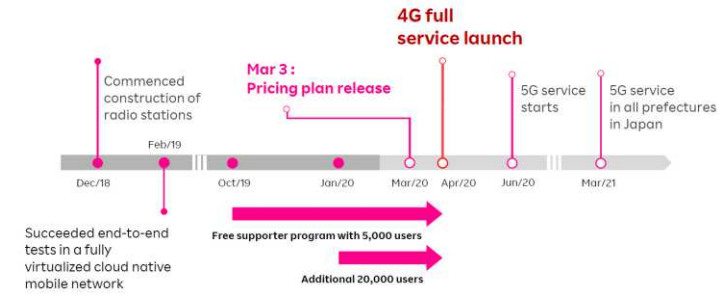
Figure 121: vRAN with COTS drive more flexibility, agility and cost saving for the 5G network enabled by open-sourced proliferation at CO and edge

Flexibility
One DU can support multiple RUs with multiple access technologies including 5G NR and 4G LTE in different bands. The DU/CU resources can also be leveraged with MEC resources.
Agility
The network can implement dynamic applications and scale out agilely by deploying different virtualized network functions (VNF) and not be constrained by proprietary hardware and software bundle.
Openness
The adoption of commercial off-the-shelf (COTS) servers could greatly reduce the infrastructure costs compared with the proprietary ones and spare operators from vendor lock-in.

Source: Wistron Wiwynn

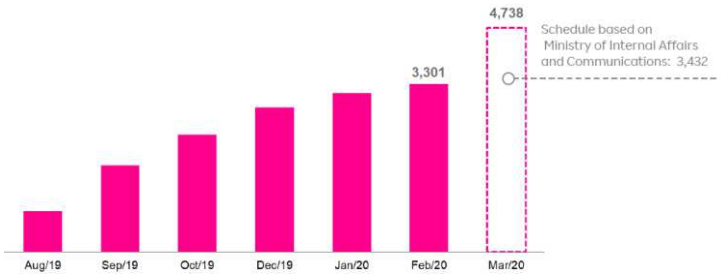
We believe Taiwan ODMs are set for a second wave of transformation from cloud to edge on the open-sourced platforms, capitalising on increasing opportunities with telecom operators on carrier premise equipment and edge compute hardware. Among all the Taiwan IT infrastructure ODMs, we believe Quanta QCT has been the front runner in the space, collaborating with Rakuten to build the world's first end-to-end cloud native mobile network. Specifically, Rakuten is a late comer into the Japan telecom space from 2014 as a MVNO (mobile virtual network operator), piggybacking NTT DOCOMO's LTE network for mobile services. According to the company, the telecom services serve as the key building blocks for its unique ecosystem encompassing e-commerce, online travel reservations, credit cards, online banking, online securities, messaging applications, and payment services, with Big Data at the core. In the end of 2017, Rakuten kicked off its plans to enter into the MNO business submitting applications for the operation of a 4G network (i.e. 1.7 GHz band) before it received government approval in April 2018. At the same time, the company also began building its own radio stations in Japan, while working to devise new network architecture based on open-sourced platforms, bringing a complete virtualised infrastructure for both core network and radio access network (RAN), supported by the standardised open-sourced cloud/edge COTS. Notably, the first successful test was already reported in Feb-2019. In addition, Rakuten officially launched the 4G service from Apr-2020 and also received approval for the 5G special radio station deployment plan for the 3.7 GHz frequency band in the same month.

Figure 122: Rakuten is a latecomer into MNO, but also has a key advantage vs peers with limited legacy infrastructure into 5G



Source: Rakuten

Figure 123: Rakuten's base station buildout ahead of the original target for 4,738 deployment (vs plan for 3,432) as of end-Mar



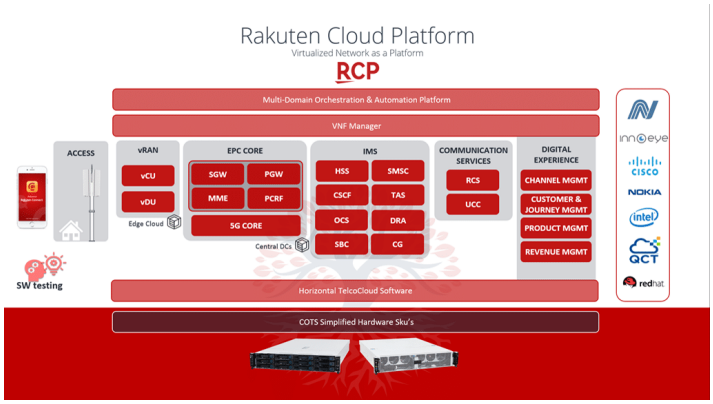
Source: Rakuten

We believe the successful demonstration by Rakuten on the world's first end-to-end cloud native mobile network should facilitate open-sourced platforms taking off with: (1) telcos supported by open-sourced cloud/edge IT infrastructure, as well as entirely virtualised RAN and core network, driving lower capex through ODM Direct; (2) lower opex through centralised deployment; and (3) fully automated services delivered through network function virtualisation (NFV). This is extremely important, along with the proliferation of 5G, given the needs to provide more variety of services through network slicing. Rakuten, leveraging the cloud native network, without the burden of a legacy infrastructure, has an advantage vs traditional telecom operators

Rakuten building the first end-to-end cloud native mobile network with open source platforms

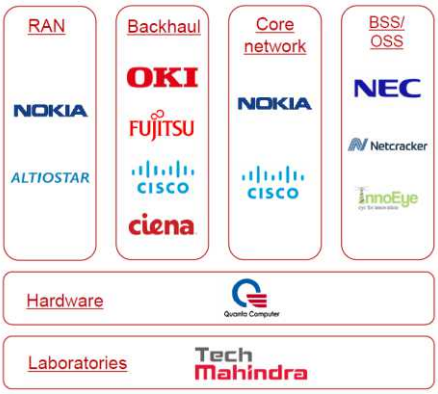
with enhanced nimbleness and flexibility for any new business opportunities driven by 5G. Within the Rakuten cloud platform, Quanta QCT is the exclusive supplier for the IT infrastructure both in the central and edge data centre segments, supporting core computing with NEC; Nokia and Altiostar for RAN; Nokia and Cisco for Core Network; and Oki, Fujitsu, Cisco and Ciena for the backhaul buildout.

Figure 124: Rakuten launched the world's first end-to-end cloud native mobile networks



Source: Rakuten

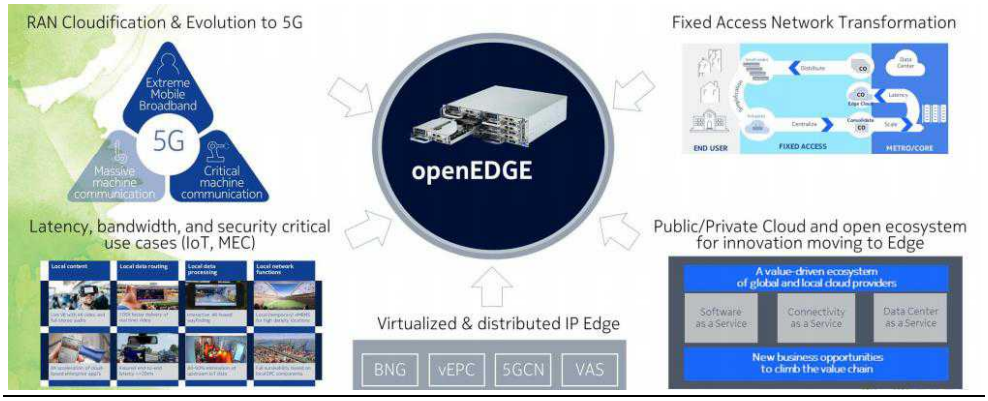
Figure 125: Full vendor line-up for the Rakuten cloud platform including Quanta QCT as exclusive hardware supplier



Source: Rakuten

While Quanta QCT has been the front-runner in the space (through its Rakuten partnership), we expect other ODMs to follow suit with more active engagement and R&D in the near term. Based on our conversations, we expect the market opportunities arising from 5G would still first be capitalised by carrier-premise IT infrastructure vendors, as they roll out their latest proprietary solutions, before the market take-off for Taiwan ODMs from 2021, supported by the proliferation of O-RAN and OCP OpenEDGE, and growing sophistication in design and customisation for the IT infrastructure ODMs. We believe this should drive better profitability in the long term, as the new businesses from 5G scale up.

Figure 126: Edge IT infrastructure enables increasing use-cases in the 5G era



Source: OCP

In addition, we believe Accton would be a key beneficiary from telcos' migration to open- sourced platforms in the long term. Currently, we believe Accton has been working with Nokia and Ericsson by providing ODM services, but it could see greater contribution from direct business engagement with telcos in the long term. Notably, in 2019, the company formed a partnership with Rakuten to provide networking solutions on its virtual platform. We believe shipments to Rakuten may be limited in the near term, but this does symbolise a key milestone for Accton, showcasing its technology competency in open-structure-based networking hardware solutions. Also, we expect Accton to see incremental growth from 5G, supporting the build-out of wireless network and higher bandwidth requirement both at cloud and edge, as well as the introduction of new applications leveraging 5G's key low-latency and high-bandwidth features.

Cloud IT infrastructure ODMs: Competitive landscape

Most of the cloud ODMs have shifted from supplying enterprises to direct service of cloud service providers

We would note the leading cloud IT infrastructure ODMs, including Quanta, Wistron/Wiwynn, Hon Hai/FII, Inventec and MiTAC, started their respective businesses focusing on providing OEM manufacturing for traditional server/storage brands, but have shifted this to CSPs along with the ODM Direct take-off in the past decade, offering increasing value addition first from L6 motherboard design, to L9 white-box density optimised server/storage arrays and L10 rack-level converged systems, and in some cases to L11 integrated systems with OS and software testing. In addition, we also see second-tier players such as Gigabyte and ASRock foraying into cloud, leveraging their speciality in PC motherboard design, as they capture uncapped business opportunities with non-hyperscalers, on smaller volume orders and higher customisation requirements. Among all, Quanta and Wiwynn are our top picks in the space, given Quanta's leading position on a more diversified customer base, as well as earlier progress into enterprise/telco, while Wiwynn continues to see the largest uplift from cloud IT infrastructure demand uptick as a pure-play cloud IT infrastructure ODM. We also like Accton as it continues to benefit from 400GbE speed-port migration with existing US hyperscale customers, while we could see potential upside from the entrance into other leading hyperscaler chains. Overall, we provide a brief summary of the key players for ODM Direct in server/storage below.

For more details on this space, please see our report Racking Up from Cloud to Edge published today.

Figure 127: Taiwan ODMs offering increasing value-add from L6 motherboard design, to L9 white-box density optimized server/storage arrays and L10 rack-level converged systems; in some cases to L11 integrated system with OS/software testing

System Type	Level	Definition
Integrated system	Level 12	Level 11 with operating system and software remaining on the system after diagnostic testing
	Level 11	Networking components, operating system, and software integrated plus diagnostic testing; operating system and software to be removed after testing
Full systems	Level 10 (rack system)	Rack-level or multirack-level system assembly and testing (including operating system testing); operating system to be removed prior to shipment
	Level 9 (node system)	Node-level full system assembling and testing (including operating system testing); operating system to be removed prior to shipment
	Level 8	Assembly of CPU, DRAM, HDD, SSD, additional storage add-ons, and testing
	Level 7	Level 6 plus add-on cards and testing
Partial systems	Level 6 (barebones system)	Level 5 system plus motherboard and testing
	Level 5	Level 4 system plus cable, heatsink, and/or fan integrated
	Level 4	Level 3 system plus power supply, and/or flat cable, and/or backplane
Component level	Level 3	Full computer chassis case
	Level 2	Parts assembly and painted chassis cover
	Level 1	Parts manufacturing, nonpainted stamped parts, molded parts

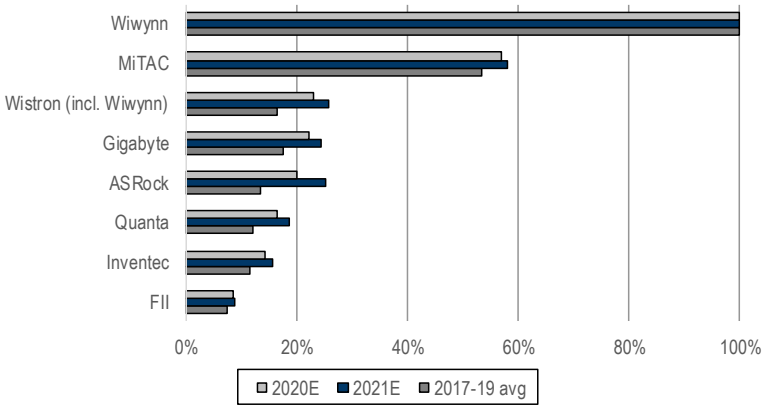
Source: Company data, IDC, Credit Suisse

Wiwynn best leveraged to hyperscalers and open-sourced platforms, followed by MiTAC

Wiwynn has among the highest leverage to the hyperscale build-out among the ODMs, followed by Mitta

Among the Taiwan ODMs, we believe Wiwynn's pure exposure in cloud IT infrastructure will offer the best leverages, capturing the opportunities arisen from further proliferation of the OCP with the hyperscalers; greater penetration of open-sourced platforms into enterprises; as well as the open-sourced platforms' take-off with telcos for carrier premise equipment and edge deployment along with the 5G proliferation. MiTAC has the second-highest exposure to cloud IT infrastructure after Wiwynn, for 50-60% of its total sales, considering MCT makes up 80-90% of MiTAC's total sales and 30-35% of its total motherboard shipments are directed to the OEM customers. We believe MiTAC's total sales in IT infrastructure will continue to recover after the business restructuring, as it reaps growing opportunities along with the cloud data-centres expansion by its key US hyperscale customer. Comparatively, most of the other leading ODMs, including FII under Hon Hai, Inventec, Quanta, and Wistron (including Wiwynn), have exposure in cloud IT infrastructure of below 30% given their diversified business operations.

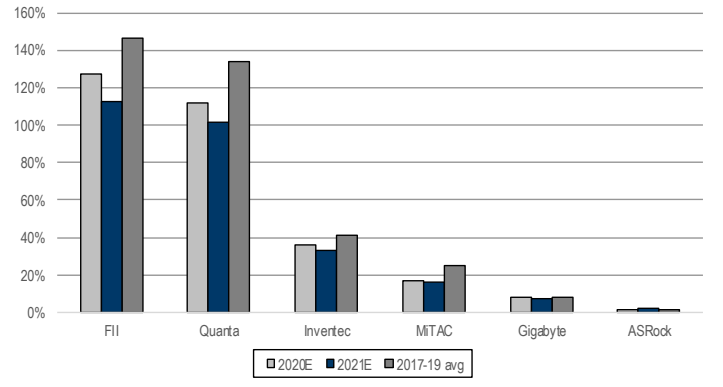
Figure 128: Wiwynn is the only pure play in cloud IT infrastructure, followed by MiTAC, providing best leverage on further proliferation of open-sourced platforms
% of total sales



Source: Company data, Credit Suisse estimates

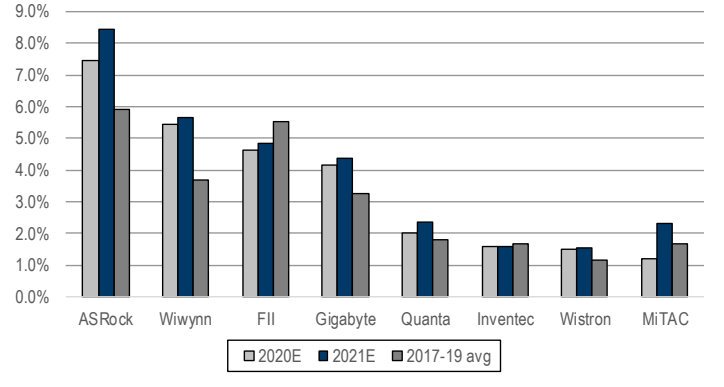
In addition, we would note FII, Quanta and Wiwynn are the three largest cloud IT infrastructure ODMs globally, with FII representing ~1-1.5x of Wiwynn's sales, factoring in ~20% of its cloud service equipment sales contribution are derived directly from hyperscalers and CSPs, despite its sales being mostly China-oriented. Also, we believe Quanta has a unique positioning among all Taiwan ODMs supported by its leading position with the US hyperscalers, as well as more diversified customers bases in enterprises (mostly Next Waves and CSPs), while it also leads the group in new business engagement with telcos for carrier premise equipment and edge compute. We expect Inventec's scale will continue to decrease as proportion of Wiwynn next few years, given the majority of its business remains on OEMs, and its shipments to the US hyperscalers are mostly based on L6 motherboards. In terms of OPM, ASRock and Gigabyte's consolidated OPMs are among the highest in the group despite the lower sales scale, supported by their larger branding business in motherboard and graphic cards, while FII also enjoys a better profitability on greater scales and components sales. Quanta's, Inventec's, and Wistron's profitability are below Wiwynn's due to the dilution from ODM/EMS in consumer electronics. Lastly, MiTAC's OPM remains low at 1% on MCT strategic re-focus.

Figure 129: FII has the largest cloud IT infrastructure sales at 1.0-1.5x of Wiwynn's, but with a primary focus in China
% of Wiwynn sales



Source: Company data, Credit Suisse estimates

Figure 130: Wiwynn's OPM % is below ASRock's as it is a pure-play cloud IT infrastructure ODM; MiTAC has been in strategic refocus in recent years
OPM %

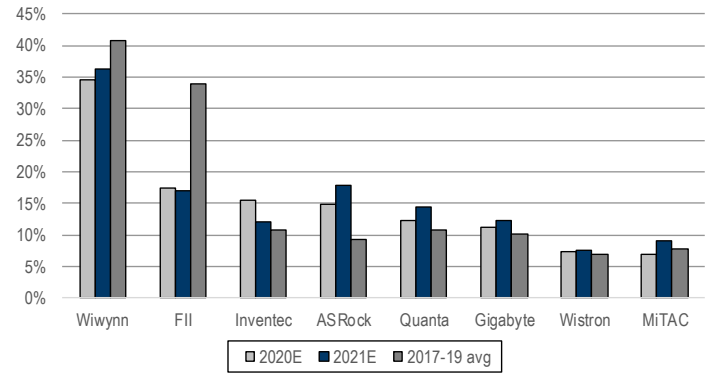


Source: Company data, Credit Suisse estimates

Notably, Wiwynn's ROE of 30-40% is materially higher than the peers' at around 10% due to its lower equity balance, given comprehensive resource support by Wistron globally, while its debt-to-equity ratio is consistent with its peers at 70-80%. We expect Wiwynn can continue to

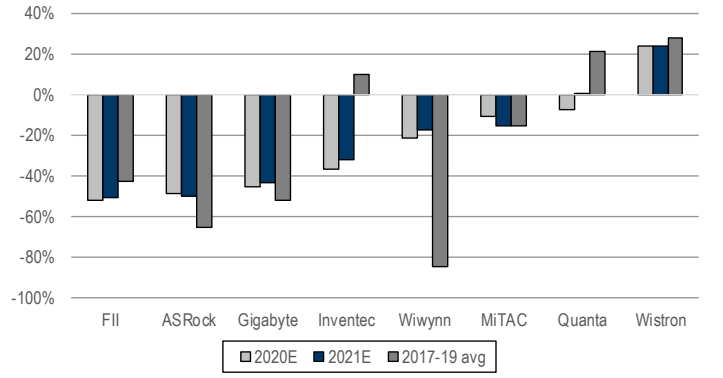
maintain its ROE at a higher level at over 30% in 2020/21E, vs a 2017-19 average of 41%, supported by the cloud demand recovery and improving component pricing. Comparatively, MiTAC, ASRock and Gigabyte's use of debt financing remain limited.

Figure 131: Wiwynn's ROE at 30-40% in 2020/21E, vs the 41% average in 2017-19, vs peers being mostly at 10-20%...
ROE %



Source: Company data, Credit Suisse estimates

Figure 132: ...despite Wiwynn's capital restructuring in line with key ODM peers
Net debt/equity %



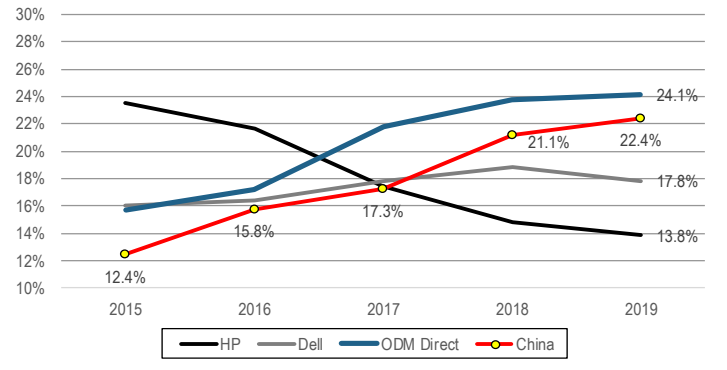
Source: Company data, Credit Suisse estimates

China vendors catching up despite limited overseas market access

China cloud IT infrastructure vendors have also made meaningful progress narrowing the technology gap with internationally leading players. Specifically, the combined revenue shares of China server OEMs delivered a 39% CAGR (vs +10% CAGR for the market) in the past five years, reaching a 22.4% share from 6.9% in 2014. We also see a similar trend taking place in enterprise storage with the combined sales of China vendors having a 20% CAGR (vs +7% CAGR for the market) over the past five years to reach a 19.5% share in 2019 vs 3.6% in 2014.

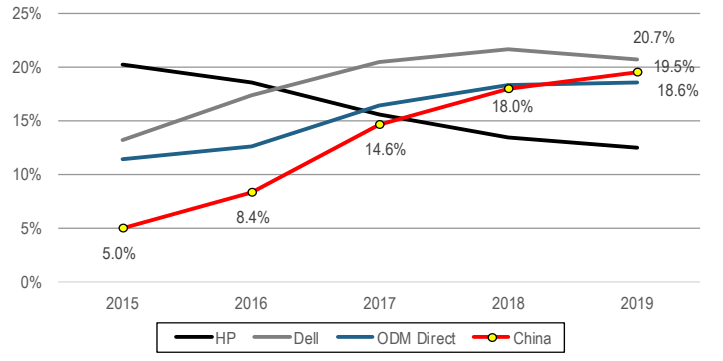
Chinese server OEMs have grown share from 7% to 22% since 2014

Figure 133: HP and Dell server shares continue to decline due to ODM Direct proliferation and China vendor expansions
Market share % by total server vendor revenues



Source: Company data, IDC, Credit Suisse

Figure 134: Similar trend also taking place in enterprise storage with increasing presence by ODM Direct and China vendors
Market share % by total enterprise storage vendor revenues



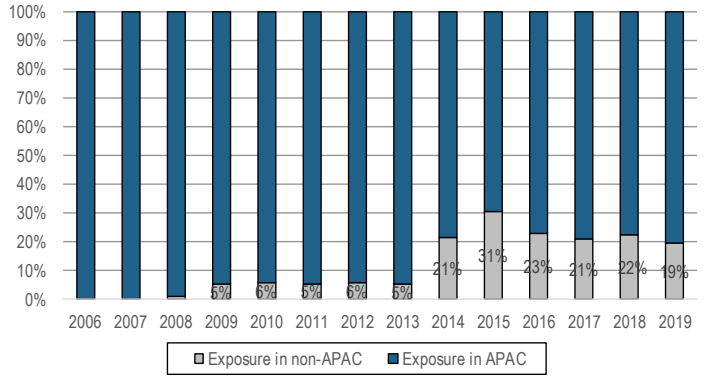
Source: Company data, IDC, Credit Suisse

We believe the key drivers supporting the growth include: (1) the expansion of APAC excluding Japan's market size (for which we believe China to be the key driver) as a proportion of the global market (27-28% of market in 2019 vs. 16-18% in 2011); and (2) an increase in Chinese vendors' share in APAC excluding Japan (55-65% of market in 2019 vs. still less than 10% in 2011-12) with good support by preferential China policy. However, we continue to believe that China vendors pose limited challenges to Taiwan ODMs over the next few years.

This is despite better progress on their home turf by offering lower pricing, given concerns on reliability and security, especially with the leading US-based hyperscalers, amid ongoing debates over the acceptance of Huawei to provide 5G infrastructure, as well as from the Bloomberg allegations of spying capability installed on Supermicro's hardware sold to the US.

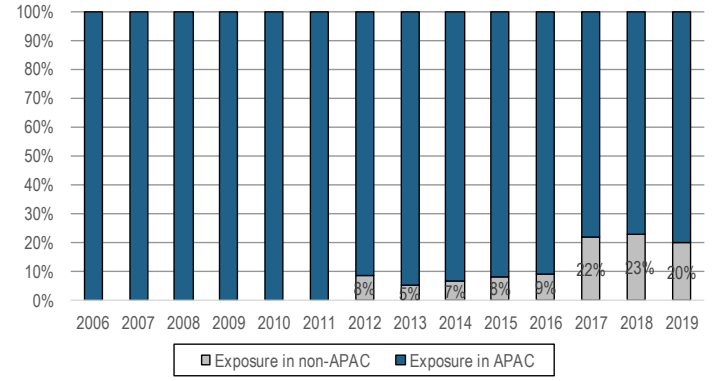
In servers, we include Great Wall, H3C, Hikvision, Huawei, Inspur, Lenovo, Powerleader, Tongfang, Sugon and ZTE in our analysis. According to IDC, total server sales from these China vendors delivered a 39% CAGR from 2014-19, representing 22.4% of the global server sales in 2019 vs 6.9% in 2014. However, most of their shipments remain in Asia Pacific (excluding Japan), and more specifically China, in our view, with only three of the ten vendors, including Huawei, Inspur and Lenovo shipping to non-APAC markets. In 2019, less than 20% of total server sales from China vendors were destined for markets outside of the APAC-region, but up from 5-6% over 2009-13.

Figure 135: Only three of the ten China server vendors are shipping outside APAC regions, making up 19% of 2019 sales
% of sales



Source: Company data, IDC, Credit Suisse

Figure 136: China vendors' combined sales outside of APAC regions also lower at 20% in enterprise storage in 2019
% of sales



Source: Company data, IDC, Credit Suisse

We would also note the similar trend of growing China vendors' presence in enterprise storages. Specifically, we have included H3C, Hikvision, Huawei, Inspur, Lenovo, Sugon and ZTE into our analysis. According to IDC, sales from Chinese vendors delivered a 50% CAGR from 2014-18, representing 19.5% of global enterprise storage sales, vs 3.6% in 2014. However, as in servers, most of their shipments remain in Asia Pacific (excluding Japan), with non-APAC sales representing nearly 20% of their total storage sales in 2019 (vs less than 10% before 2017), and only Huawei, Inspur and Lenovo making their way to overseas markets.

Chinese vendors have grown enterprise storage share from 4% to 20% since 2014

Figure 137: China vendors as a whole have a majority of shipments still concentrated in the volume segment
Market share % by server sales in 2019

	Total	High-End Enterprise	Midrange Enterprise	Volume
HP	13.8%	4.4%	29.1%	11.7%
Dell	17.8%	0.0%	17.9%	19.3%
IBM	5.9%	68.7%	8.3%	0.0%
ODM Direct	24.1%	0.0%	8.4%	29.2%
China	**22.4%**	**1.3%**	**13.8%**	**25.8%**
Inspur	7.3%	0.0%	3.0%	8.6%
Lenovo	5.7%	0.7%	4.7%	6.3%
Huawei	4.2%	0.3%	4.8%	4.4%
H3C	3.3%	0.3%	1.0%	4.1%
Sugon	1.2%	0.0%	0.2%	1.4%

Source: Company data, IDC, Credit Suisse

Figure 138: China vendors also have a leading exposure in the entry segment, but ramping up in the mid-range
Market share % by enterprise storages sales in 2019

	Total	High End	Midrange	Entry
HP	12.5%	13.4%	18.6%	9.2%
Dell	20.7%	20.7%	23.1%	19.5%
IBM	6.2%	33.6%	6.7%	0.3%
ODM Direct	18.6%	0.0%	3.4%	30.1%
China	**19.5%**	**3.0%**	**15.2%**	**25.1%**
Inspur	5.8%	0.7%	1.6%	8.9%
Lenovo	4.7%	0.5%	5.0%	5.5%
Huawei	4.7%	1.0%	6.2%	4.7%
H3C	3.0%	0.8%	1.6%	4.1%
Sugon	1.1%	0.0%	0.6%	1.5%

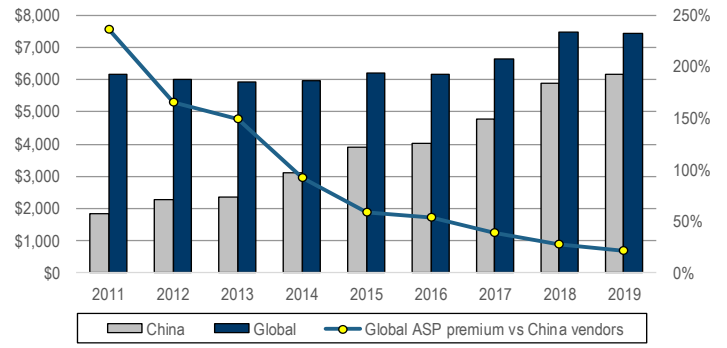
Source: Company data, IDC, Credit Suisse

Among all the shipments made by the China vendors, the majority of them are volume servers with an average selling price of below US$25,000, based on IDC's definition. On a blended basis, China vendors have an average selling price at US$6,152, or a 17% discount to the global average of US$7,433. In the mid-range segment for pricing between US$25,000 and US$249,999, the market continues to be led by US vendors, especially HP (29%) and Dell (18%), and China vendors as a whole represent 13.8% of total mid-range sales. High-end

enterprise servers (i.e., an ASP above US$250,000) accounted for 7% of the overall market in 2019, with Lenovo, Huawei and H3C the only Chinese vendors competing in the segment despite overall shares remaining limited. IBM dominates this segment, representing 69% of total units.

Figure 139: Global server ASP at a premium of more than 20% vs China vendors'

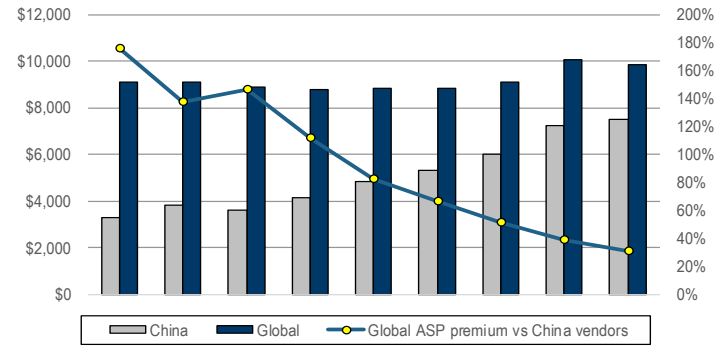
ASP in US$ (L-axis) and % of premium vs global vs China (R-axis)



Source: Company data, IDC, Credit Suisse

Figure 140: China enterprise storage vendors catching up, but still at a 20-25% discount to the global average

ASP in US$ (L-axis) and % of premium vs global vs China (R-axis)



Source: Company data, IDC, Credit Suisse

Similarly, the majority of China vendors' exposure to enterprise storage also remains entry grade solutions with an average selling price of below US$25,000 based on the IDC definition. On a blended basis, China vendors' ASP was US$7,529 in 2019, or nearly a 24% discount to the global ASP of US$9,863. In the mid-range segment for pricing between US$25,000 and US$250,000, the market continues to be led by US vendors, including Dell (23%), HP (19%) and IBM (7%), with China vendors as a whole representing 15% of total mid-range sales. High-end solutions (i.e., an ASP above US$250,000) accounted for 12% of overall market sales in 2019, with Huawei and Lenovo the only sizeable Chinese vendors competing, while IBM and Dell led the segments, making up 34% and 21% of global sales, followed by HP's 13%.

For the China market, we maintain our view that cloud IT infrastructure spending by the leading China hyperscalers would be captured mainly by key China IT infrastructure vendors including Huawei, H3C, Inspur, Lenovo and Sugon. However, we believe Chinese vendors should face even higher pressure from expanding overseas, especially with the leading US hyperscalers, given concerns on reliability and security vs pricing, and amid the ongoing debate surrounding security vulnerability and potential backhaul breaches on Huawei-sourced carrier premise equipment, which is even more sensitive in the 5G era.

Lenovo is the only China vendor with meaningful overseas hyperscaler exposure

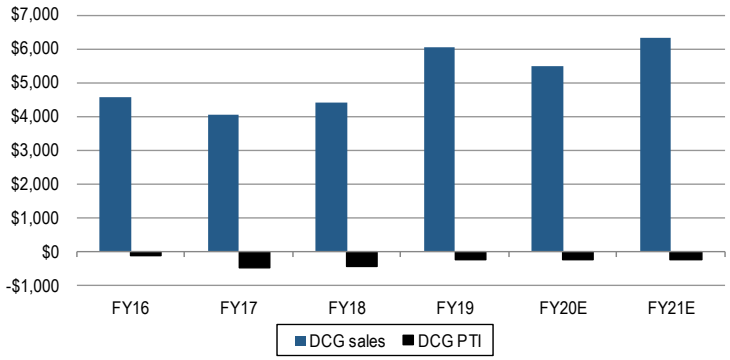
Lenovo is ahead of its peers gaining share to hyperscale vendors

Among all the China IT infrastructure vendors, we believe that Lenovo is the only vendor having business engagement with one of the leading US hyperscalers (i.e. Microsoft), leveraging its globally leading position in PC. We see limited progress near term with other US hyperscalers, as Taiwan cloud IT infrastructure ODMs continue to dominate the market supported by healthy relationships with open-sourced platforms. Based on our conversations, we believe the US hyperscalers would also be more reluctant to switch suppliers, barring a major fiasco, as they value companies with a long track record of reliability/security, vs pricing.

On the other hand, Lenovo's management noted it has been shifting more resources to the China cloud IT infrastructure market by hiring of 200-300 new staff. It has already seen good progress with the Next Wave customers in China, with key customers wins including Meituan, JD.com, Kuaishou, etc. and is looking to capitalise on the expanding opportunities with the 250 Next Wave customers through further sales force expansion. We think the shift of its focus to the domestic business with a new family of products is the right strategy, given that Chinese enterprise customers are very sensitive on price/performance. We believe this could help reduce its reliance on hyperscale customers and fuel its DCG sales growth in the longer term, but could delay the turnaround of DCG business due to the upfront investment on opex and competition from peers, resulting in weaker margins.

Overall, Lenovo expects its DCG group to see better sales in FY21 (FYE: March 2021), as it guided continued profitability growth, vs a US$226 mn loss in FY20, driven by an improving cloud (currently ~30% of DCG sales) outlook, and the demand uptick from the increasing workload shift to the cloud amid COVID-19.

Figure 141: Lenovo's DCG profit should remain in loss through FY21E
Sales and PTI in US$ mn



Source: Company data, Credit Suisse estimates

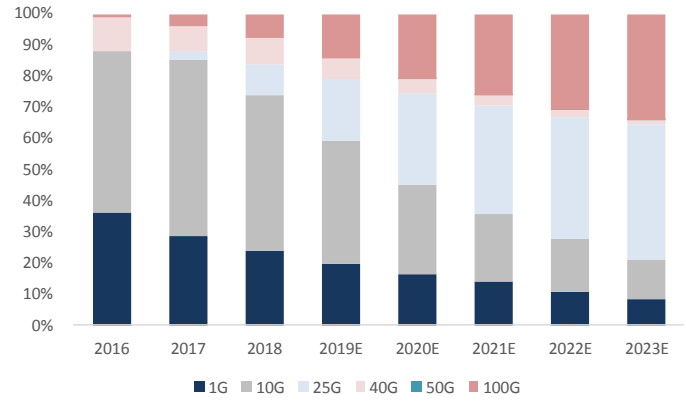
Rise of Merchant Silicon: Broadcom and Marvell

ASIC to Merchant Conversion: The data-centre infrastructure innovation cycle is seeing disruption, as demand by large operators cannot be served by the traditional model, which entails OEMs collaborating with silicon vendors. In response to the challenge, OEMs such as HP, Dell, and JNPR are incorporating merchant silicon and actively supporting open standards. However, we would note that the conversion process is still relatively slow, especially in the enterprise market.

Broadcom and Marvell leading in merchant silicon, although Mediatek is also starting to make inroads with Cisco and Google

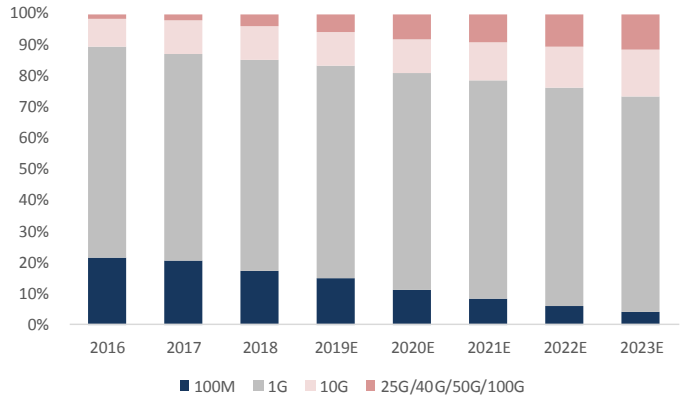
In the switch silicon business, Broadcom and Marvell both see a sizeable opportunity as ASICs become displaced by merchants, specifically, the enterprise, data centre and carrier/service provider markets. Mediatek has also invested US$300 mn in R&D building out its ASIC team for data centre and secured design wins, with a data-centre switch ASIC with Cisco and an AI accelerator with Google.

Figure 142: Datacentre switch mix over time



Source: Company data, IDC, Credit Suisse

Figure 143: Total enterprise switch mix over time



Source: Company data, IDC, Credit Suisse

Enterprise fixed and modular conversion: This vertical primarily consists of campus wiring closet boxes, and campus aggregation and campus core platforms. This market is evenly divided between CSCO, which is still using ASIC, and the other players (HP, Dell and JNPR, etc.) that have moved to merchant, taking merchant to a 20-50% market share.

Data centre fixed and modular: Merchant share has now reached ~50% in data centre. Broadcom especially has made progress in this segment over the past few years, particularly on the fixed side, and more recently it has been starting to make headway on the modular side. In 2014, CSCO started shipping the Nexus 9000, which is the first data-centre modular platform that shipped with Broadcom's Silicon. Broadcom sees data centre top-of-rack and data-centre modular platforms as a ~ US$1 bn opportunity.

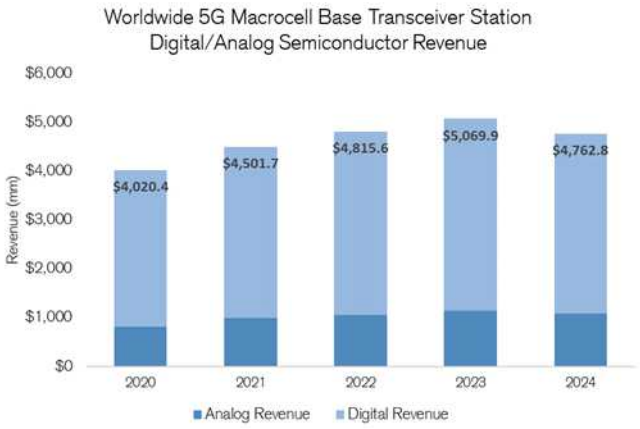
Carrier Ethernet switch: Merchant share has now reached ~50% in carrier Ethernet switches. This vertical primarily consists of backhaul and aggregation. In provider edge/core routers, merchant share is still relatively low at ~20-50% and in packet optical transport the merchant share is also still relatively at ~20-50% as well. Most packet optical transport platforms do not have much Ethernet content inside, but they will need to and therefore Broadcom, Marvell, and other players are expected to gain share in the segment.

5G increasing content to drive growth

5G baseband content growing by 4x versus 4G to US$2,500-3,000 per base station

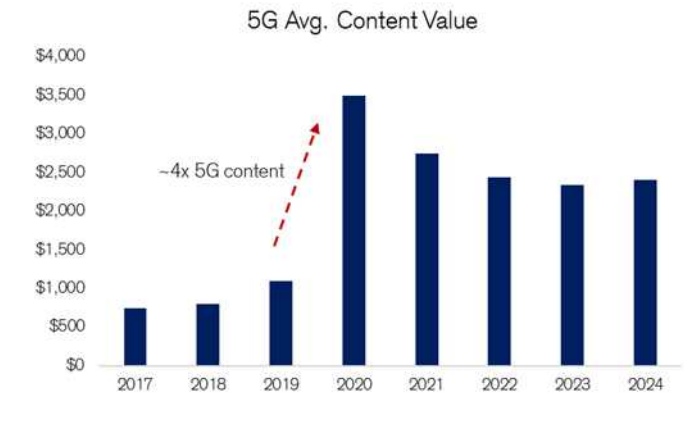
In the carrier space, Marvell is one of the only merchant baseband suppliers for base stations. This has led to key contracts with Samsung, supplying 4G basebands and which has recently been extended to 5G/MIMO rollouts using OCTEON/Fusion processors (announced 20 March 2020). The revenue potential of 5G is significantly larger than for 3G/4G—with content per station increasing from US$200 (3G) to the high US$700-800 (4G/LTE), with 5G projected to be 4x higher—about US$2,500-$3,000 per station. Marvell has already outlined line-of-sight revenue of US$600 mn from Marvell/Cavium, with another US$150 mn from Avera, or totalling US$750 mn with ~10% market share today. We expect additional upside from the 3 March 2020 announcement of a partnership with NOK for multiple generations of custom/multi-core ARM-based processors for 5G rollouts—beginning to add revenue in 2H FY21. This is also a segment of merchant silicon that we expect to attract other entrants.

Figure 144: 5G base station revenue to peak in 2023



Source: Company data, Credit Suisse estimates

Figure 145: ~4x the average base station content value

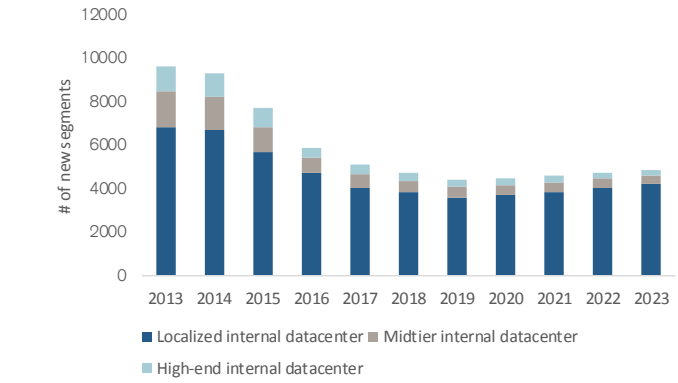


Source: Company data, Credit Suisse estimates

Data centre in security and networking services: Historically, Cavium had a strong position with data-centre customers through the security and networking services offload—and therefore after being acquired by MRVL it is considered the leader in the space. This capitalises on two major trends driving the evolution of data centres: (1) distributed security and network services; and (2) the push towards having cloud-optimised ARM server processors. MRVL's processors for data centres are unique in that they have the ability to integrate both security with data plane processing, and this has been an area that the company continues to emphasise and build out. Another area in which Marvell's processors stand out is that they have an ARM architecture licence, which means Marvell can make changes to hardware built on ARM as long as the resulting design would comply with ARM's architecture.

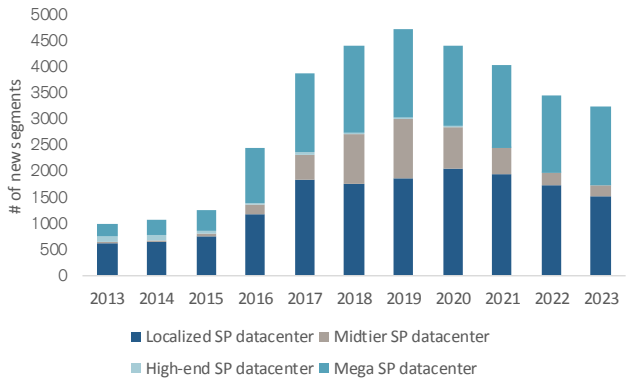
Artificial Intelligence: Artificial intelligence (AI) and machine learning have often been described as the data for the 21st century and Marvell wants to be a part of this trend. Marvell has been focused on building out an AI-focused chip that specialises in inference—in particular building out its ARM-focused ThunderX family of server processors, which it hopes in the future to be sized appropriately for its hyperscale customers.

Figure 146: Worldwide new internal data centre builds



Source: Company data, Credit Suisse

Figure 147: New service provider data centre builds

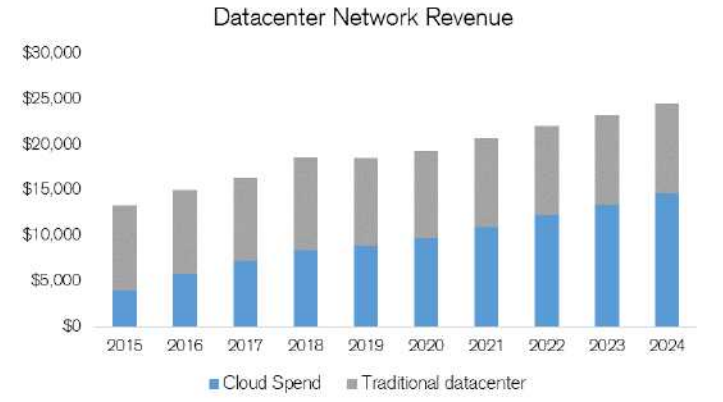


Source: Company data, Credit Suisse

Cloud opportunity within merchant is rapidly expanding

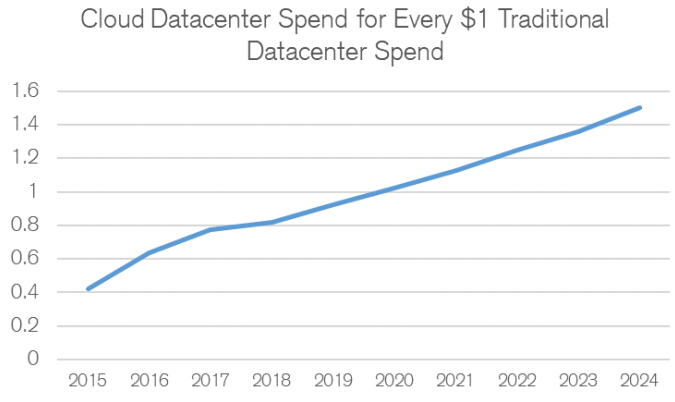
Marvell, for the first time (1Q20), disclosed that its revenue from the cloud market has exceeded 10% of total revenue—as it has worked to build a strong cloud franchise combining storage, networking and processor technology, and also has the unique ability to deliver products with standard, custom and semi-custom solutions. Importantly, the CEO commented that the cloud data centre market *represents an opportunity for both storage and networking products similar in magnitude to 5G*—implying ~US$750 mn near-line revenue. Cloud data centre spend is expected to outpace traditional data centre growth with a +11% CAGR vs traditional's ~0.3% CAGR through 2024 (vs. overall data centre spends +5.7% CAGR); in other words, by 2024 cloud spend would be 1.5x traditional on-premises spend. Through the CAVM/Avera acquisitions, MRVL has positioned itself well for both storage and networking in the cloud with its NVMe accelerators, LiquidIO, and SmartNIC products.

Figure 148: Cloud data centre revenue delivering ~11% CAGR



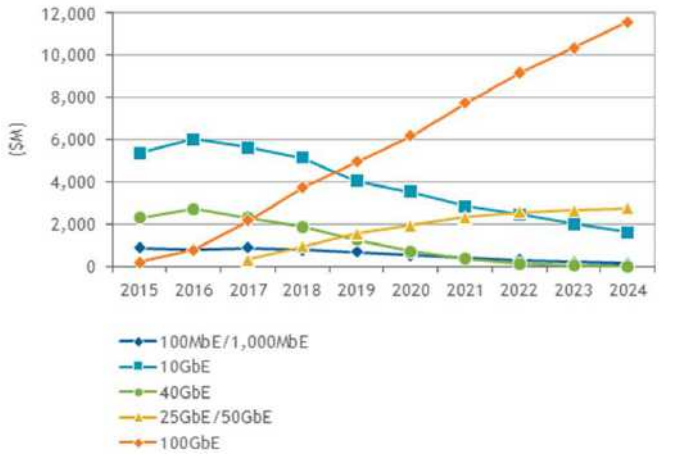
Source: Company data, IDC, Credit Suisse estimates

Figure 149: Cloud spend is 1.5x on-premise spend



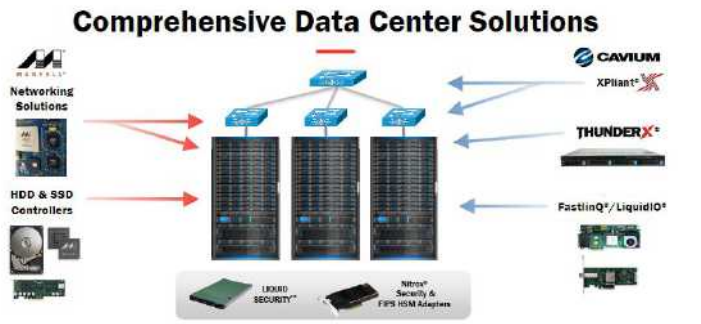
Source: Company data, IDC, Credit Suisse estimates

Figure 150: Data-centre Ethernet switch rev growth in 100Gb



Source: IDC

Figure 151: Aligning with MRVL+CAVM DC solutions



Source: Marvell

Sector investment risks

The following are the key risks to the cloud infrastructure hardware sector:

Sector risks from volatile capex, COVID-19 volatility, component pricing and constraints and competitive pressures

- **Hyperscalers' capex spending is cut along with changes in the business outlook and macro economy.** We believe that globally leading hyperscalers' capex planning should lead to changes in the magnitude and intensity of cloud IT infrastructure pull-in, which would have a profound impact on Taiwan cloud IT infrastructure ODMs' sales outlook. In addition, we believe hyperscalers' capex is much dependent on the macro-economy, leaving aside the difference in cloud service offerings, business models and operation. In 2019, hyperscalers' capex spending was weaker after aggressive inventory pull-in from 2017-18, along with component pricing declines. We will continue to monitor the impact of COVID-19 on the macro-economy as well as capex spending by the hyperscalers; however, we believe order bookings remain healthy at this point, despite some spending push-off due to supply chain and logistic bottlenecks based on our conversations.
- **Regional lockdown amid COVID-19 driving incremental costs.** We believe the recent global lockdown amid the COVID-19 outbreak have led to more difficult supply chain management by the Taiwan cloud IT infrastructure ODMs, which could drive incremental costs associated with logistics and transportation, as well as additional raw material inventory preparation on potentially higher pricing structures due to less efficient supply chains. According to our conversations, while Taiwan ODM SMT lines are all located in Taiwan and China, they have also established local rack-assembly production and offices close to their markets in the US and Europe to drive more efficient after-market support and delivery. Nevertheless, due to COVID-19 and the aftermath impact from lockdown, Taiwan ODMs might be required to offer more flexible cross-region manufacturing support and delivery, leading to higher costs structure in the near term, despite these incremental costs possibly being remedied by the CSPs, especially the globally leading hyperscalers, afterwards.
- **Key component pricing fluctuations.** We would note that key components for cloud IT infrastructure include CPU/GPU, memory, storage, etc., making up 80-90% of the total BOM of standard rack equipment, with these key components often negotiated by hyperscalers, for subsequent consignment for Taiwan ODM production and management. Given that the costs of these key components are mostly passed through into the final price, this can lead to significant changes in the sales and profitability reporting by ODM players. Evidently, Wiwynn's sales in 2019 were weaker partially as a result of the falling memory pricing; however, its GM grew modestly to 6.9% from 5.9% for the same period.

- **Potential CPU shortages leading to earlier projects termination.** We see limited risk from the constraints and shortages in cloud IT infrastructure CPU in the near term, despite the recent lockdown in Southeast Asia where much of the semiconductor backend production is housed, given the prioritisation by Intel to the higher margin cloud IT infrastructure segments especially for the hyperscalers. Nevertheless, we would still highlight the potential risk from the CPU shortage, especially during the next-generation node transition (i.e. from the Purley platform using the 14 nm based Cascade Lake chipset to the Whitley platform using the 10 nm-based Ice Lake chipset). We have also picked up further delays for the rollout of the 10 nm-based Ice Lake into 2021 from the supply chain. Evidently, we have seen the earlier termination of project rollouts by tier 2/tier 3 CSPs due to the sudden cut of chipset supplies on the older Grantley platform at the end of 2019, as Intel optimised its in-house capacity for the latest generation platforms, leading to material changes in the outlook. However, we also see greater progress with AMD in cloud IT infrastructure, representing nearly 10% of total motherboard shipments, supported by better technology advancement (i.e. latest EPYC2 on 7 nm node fabbed by TSMC), amid Intel supply shortages.

Figure 152: Intel server CPU roadmap overview

Family Branding	Haswell	Broadwell	Skylake-SP	Cascade Lake-SP/AP	Cooper Lake-SP/AP	Ice Lake-SP	Sapphire Rapids
Process Node	22nm	14nm	14nm+	14nm++	14nm++	10nm+	10nm++
Platform Name	Intel Grantley	Intel Grantley	Intel Purley	Intel Purley	Intel Whitley	Intel Whitley	Intel Eagle Stream
Max Core Count	Up To 16	Up To 22	Up To 28	Up To 28 Up To 48	Up To 28 Up To 48	Up To 38	TBD
Memory Support	DDR4-2133 4-Channel	DDR4-2400 4-Channel	DDR4-2666 6-Channel	DDR4-2933 6-Channel DDR4 2933 12-Channel	Up To 8-Channel DDR4	8-Channel DDR4	8-Channel DDR5
PCIe Gen Support	PCIe 3.0	PCIe 3.0	PCIe 3.0	PCIe 3.0	PCIe 3.0	PCIe 4.0	PCIe 5.0
Competition	n.a.	n.a.	AMD EPYC Naples 14nm	AMD EPYC Rome 7nm	AMD EPYC Rome 7nm	AMD EPYC Milan 7nm+	AMD EPYC Genoa 5nm
Launch	2013	2014/15	2017	2018	2019	2020	2021/22

Source: Company data, Credit Suisse

- **Increasing competition driving changes in market share and profitability.** We see limited risk from new entrants in the short-to-mid term, as it often requires years of lead time for qualification, aside from the need to have a long track-record of reliability and quality credentials, which are more important factors for globally leading hyperscalers, as compared to a pure focus on costs. In addition, we believe Taiwan leading cloud IT infrastructure ODMs also have very large manufacturing scale and global sales office support for after-market services, as well as greater capital intensity for key raw material procurement and inventory management, setting a higher bar for any potential entrants. However, we see potential changes in shares among the ODMs with the hyperscalers, given that the offering of cloud IT infrastructure is all based on the commonly designed open-sourced platforms. For example, after some delays, Wiwynn has successfully entered the Amazon cloud IT infrastructure supply chain, along with FII, Inventec, MiTAC and Quanta, with small-volume rack shipments (no motherboards) in 2Q20, before a more meaningful ramp into 2H, which could be a key driver for Wiwynn next few years.

Supply chain opportunities

Figure 153: Global technology suppliers leveraged to cloud data-centre growth

Name	Ticker	Rat	Curr.	Price (LCY)	Target Price	Mkt cap (USD mn)	PE (x) 2020	PE (x) 2021	EPS growth (%) 2019	EPS growth (%) 2020	EPS growth (%) 2021	Yield (%) 2020	PB (x) 2020	ROE (%) 2020
Asian Hardware														
Accton	2345.TW	N	TWD	236.50	240.00	4,500	26.1	20.1	67.3	2.4	30.3	2.9	9.2	35.4
Delta Electronics	**2308.TW**	**O**	**TWD**	**184.00**	**208.00**	**16,037**	**23.7**	**20.5**	**27.1**	**(13.8)**	**15.9**	**3.0**	**3.2**	**13.6**
FII	**601138.SS**	**O**	**CNY**	**14.79**	**17.00**	**43,486**	**16.9**	**14.9**	**9.2**	**(3.4)**	**13.2**	**1.2**	**3.0**	**17.6**
Hon Hai	2317.TW	O	TWD	88.00	93.00	40,819	12.2	10.7	3.6	(14.3)	14.2	4.6	1.0	7.8
Inventec	2356.TW	N	TWD	24.75	24.00	3,061	10.5	13.7	(15.3)	56.4	(23.3)	6.6	1.7	15.8
Lenovo	0992.HK	N	HKD	4.55	4.50	7,098	10.6	8.5	11.3	0.4	23.8	5.4	1.6	14.9
MiTAC	3706.TW	N	TWD	29.55	32.20	1,214	12.9	9.2	(14.2)	(1.9)	40.3	3.0	0.9	6.9
Quanta	**2382.TW**	**O**	**TWD**	**78.00**	**90.00**	**10,351**	**17.2**	**14.7**	**5.5**	**11.0**	**17.4**	**5.9**	**2.2**	**12.8**
Shengyi Tech	**600183.SS**	**O**	**CNY**	**29.00**	**48.10**	**9,727**	**35.1**	**27.2**	**25.5**	**29.2**	**28.9**	**1.8**	**5.6**	**16.0**
Shennan Circuits	002916.SZ	N	CNY	162.67	194.60	11,281	45.9	36.5	58.6	(8.9)	25.9	0.7	12.7	27.7
Wiwynn	**6669.TW**	**O**	**TWD**	**753.00**	**960.00**	**4,727**	**17.4**	**11.8**	**(2.1)**	**16.6**	**47.6**	**3.9**	**5.3**	**34.6**
ZTE	0763.HK	O	HKD	23.00	26.10	25,026	19.1	14.4	- to +	(9.1)	32.6	0.9	2.9	15.3
Asian Semiconductors														
Alchip Tech	**3661.TW**	**O**	**TWD**	480.00	630.00	982	30.5	22.5	71.9	114.5	35.5	0.7	7.1	23.3
Amkor	AMKR.OQ	N	USD	12.16	12.00	2,932	18.2	15.3	(5.0)	33.0	18.7	0.0	1.4	7.6
Anritsu	6754.T	O	JPY	2,435.00	2,880.00	3,159	21.3	20.6	35.0	31.4	3.3	1.4	3.2	15.1
ASE	3711.TW	O	TWD	69.30	84.00	10,381	11.8	10.9	3.8	12.7	8.3	3.4	1.4	12.2
Aspeed	**5274.TWO**	**O**	**TWD**	1,255.00	**1,300.00**	**1,480**	**41.8**	**34.5**	**20.7**	**25.1**	**21.3**	**1.6**	**18.4**	**44.0**
GUC	3443.TW	N	TWD	284.00	250.00	1,325	72.8	33.9	(35.9)	(15.3)	114.9	1.7	8.9	12.3
MediaTek	2454.TW	O	TWD	607.00	730.00	32,393	29.7	20.2	31.6	39.2	47.0	1.7	3.1	10.3
Parade	4966.TWO	N	TWD	1,075.00	970.00	2,795	26.3	22.3	22.3	27.9	18.2	1.5	6.2	23.4
Renesas	6723.T	O	JPY	593.00	1,290.00	9,545	10.8	9.5	(50.0)	262.7	13.8	0.0	1.4	13.0
Samsung Elec	**005930.KS**	**O**	**KRW**	**54,400**	**65,000**	**268,891**	**15.4**	**11.0**	**(51.0)**	**10.0**	**40.0**	**2.6**	**1.4**	**8.8**
SK Hynix	**000660.KS**	**O**	**KRW**	**82,900**	**118,000**	**49,731**	**13.0**	**6.9**	**(87.0)**	**114.4**	**87.7**	**0.0**	**1.1**	**8.1**
TSMC	**2330.TW**	**N**	**TWD**	**367.00**	**365.00**	**321,942**	**20.3**	**20.1**	**(1.7)**	**35.2**	**1.1**	**2.7**	**5.2**	**25.7**
Global Hardware														
Dell	DELL	N	USD	60.37	44.00	44,723	11.4	9.6	16.9	(28.1)	19.2	0.0	9.0	79.1
HPE	HPE	U	USD	9.67	8.50	12,424	8.0	7.4	19.7	(31.4)	7.5	5.0	1.0	12.3
IBM	IBM	O	USD	125.11	150.00	111,084	11.5	10.1	(7.3)	(15.0)	13.2	5.4	5.0	43.2
NetApp	NTAP.OQ	O	USD	44.81	53.00	9,940	13.1	10.2	(9.2)	(16.4)	28.8	4.3	9.4	72.1
Global Semiconductors														
AMD	AMD.OQ	N	USD	55.04	33.00	64,462	66.7	46.8	55.5	63.4	42.5	0.0	19.2	28.7
Broadcom Ltd	AVGO	O	USD	312.71	400.00	141,888	14.5	12.9	2.3	0.9	12.3	1.8	6.6	45.5
Intel	**INTC.OQ**	**O**	**USD**	**60.00**	**75.00**	**254,040**	**12.7**	**12.0**	**9.2**	**(7.2)**	**6.1**	**2.2**	**2.6**	**20.6**
Micron	**MU.OQ**	**O**	**USD**	**49.47**	**90.00**	**54,961**	**19.1**	**9.9**	**(47.7)**	**(58.0)**	**92.7**	**0.0**	**1.5**	**7.7**
NVIDIA	**NVDA.OQ**	**O**	**USD**	**408.06**	**425.00**	**250,957**	**70.4**	**49.5**	**(11.5)**	**(14.2)**	**42.3**	**0.0**	**15.8**	**22.5**
Xilinx	**XLNX.OQ**	**O**	**USD**	**100.49**	**100.00**	**24,439**	**37.6**	**31.1**	**(5.2)**	**(19.1)**	**20.6**	**0.0**	**8.5**	**22.8**
Datacenter and cloud operators														
21Vianet	VNET.OQ	O	USD	24.11	25.00	2,723	(147.4)	(131.2)	10.0	29.4	(12.4)	0.0	3.6	(2.5)
Alibaba	**BABA**	**O**	**USD**	**247.14**	**309.00**	**668,430**	**28.2**	**23.1**	**37.9**	**15.5**	**22.2**	**0.0**	**5.0**	**17.8**
Digital Realty	**DLR.N**	**O**	**USD**	**143.75**	**164.00**	**38,570**	**83.9**	**63.8**	**94.6**	**(27.2)**	**31.6**	**3.1**	**2.5**	**10.5**
Equinix	EQIX.OQ	O	USD	724.23	704.00	64,105	30.1	28.1	10.3	5.3	7.0	1.5	4.9	15.4
GDS	**GDS.OQ**	**O**	**USD**	**81.08**	**90.00**	**12,958**	**(1794.7)**	**1093.4**	**(4.4)**	**91.3**	**- to +**	**0.0**	**5.9**	**(0.3)**
Keppel DC REIT	KEPE.SI	O	SGD	2.61	2.91	3,124	26.5	25.6	5.5	10.8	3.6	3.4	2.2	8.0
Kingsoft Cloud	**KC.OQ**	**O**	**USD**	35.73	50.30	7,334	(56.3)	(71.5)	44.1	73.9	21.2	0.0	8.2	(14.6)
Switch, Inc.	SWCH.N	O	USD	17.95	23.00	4,337	121.0	64.1	11.0	15.1	88.7	0.0	6.1	5.0

Note: Names in bold are our preferred ideas currently. Priced as of 20 July 2020. O = Outperform, N = Neutral, U = Underperform.

Source: Company data, Credit Suisse estimates

Top stocks with leverage to the cloud data centre growth opportunity

The cloud/datacentre opportunity impacts all parts of the technology supply chain globally and this opportunity is likely to grow significantly as the development of 5G–led technologies further accelerates existing trends. Within Asian downstream, certain ODMs are key beneficiaries of this trend, supported by further proliferation of the Open Compute Project (Quanta, Wiwynn). The shift to cloud infrastructure is a negative for US Hardware OEMs, though we like IBM and NetApp's positioning in a hybrid-first world. Significant design changes for components requiring the ability to deal with high bandwidth, low latency and massive connectivity leads to opportunities for names such as Delta, FII, Hon Hai and Shengyi in China. Within semis, IC Design and advanced foundry get a lift from high performance computing (TSMC, Aspeed) and IC design service companies (Alchip) are providing design support to help system and fabless

companies to design complex high performance computing chips. In the US, top picks on the accelerating compute TAM are NVIDIA, Intel, AMD, Micron and Xilinx. Public cloud service growth from hyperscalers will support server DRAM growth (now 35% of memory), supporting the memory demand side (Samsung, SK Hynix and Micron). Amongst data centre operators, globally we highlight Equinix, Digital Realty and Switch and in China, GDS and VNET.

Within semis, advanced foundry and packaging get a lift from high-performance computing (TSMC, Aspeed) and IC design service companies (Alchip) are providing design support to emerging fabless companies, helping them bring to market complex high-performance computing chips. In the US, our top picks for companies most levered to this theme are NVIDIA, Intel, AMD, Micron and Xilinx. As public cloud services become more dominated by hyperscalers, the rapid growth should drive a steady demand increase for server DRAM, which has already grown to nearly 35% of the total DRAM market (Samsung, SK Hynix and Micron).

Asian Hardware: PCs and ODMs (Jerry Su, Harvie Chou)

Quanta a top pick in hardware, also Initiating on Wiwynn with Outperform

We believe that Taiwan IT infrastructure ODMs are key beneficiaries from the continued expansion of global cloud spending by the leading US-based hyperscalers, supported by further proliferation of OCP, Taiwan ODMs' leadership on the open-compute platform, as well as their respective long-standing hardware design/manufacturing know-how and global after-market service support.

In this space, Quanta is our top pick among Taiwan ODMs, as we believe it can maintain its leading position with its more diversified customer base and earlier progress into enterprise/telco, driving enhanced long-term profitability. We also believe Accton would be a key beneficiary from the open-sourced platform take-off in networking switching, along with 400GbE speed-port migration, as well as new opportunities in 5G telco, but we see limited upside after the more than 100% run its share price YTD. We initiate coverage on Wiwynn with an OUTPERFORM rating ,as we expect it to see the largest momentum uplift from cloud IT infrastructure demand uptick, as the only pure play cloud IT infrastructure ODM with unique positioning with US hyperscalers, aside from new customer ramp from May 2020.

Asian Hardware: Components/EMS (Pauline Chen)

Silicon scaling limitations, exponential data processing, broader machine-learning frameworks, on-device intelligence and 5G adoption have led to significant design changes for hardware components. How to deal with high bandwidth, low latency and massive connectivity, while meeting cost efficiency is also important, given a huge ASP increase on design change and an estimated 40% of electrical power used to cool down a data-centre. We expect the above trend to provide growth opportunities for the component sector, including high-speed/high-frequency design and better thermal dissipation technology.

Delta and FII/Hon Hai best placed in hardware components

Delta and FII/Hon Hai are well positioned to capture the data-centre opportunity in our coverage. We believe Delta's core competence in highly efficient power electronics and its rich product offerings (including server power supply, telecom power supply, cooling, power chokes and networking, etc) should continue to help it stay ahead of the power/energy efficiency competition. We expect FII/Hon Hai to gain market share in the fast-growing cloud market, thanks to its share gains in CSP (cloud service provider). While FII's CSES generates a lower-than-peer GM (at 4% in 2019, vs. Wiwynn's 6.9%), due to its higher exposure to enterprise customers, we expect its continued market share gains in CSP (especially Microsoft) to drive margin improvement in CSES in 2020-21E.

Asian Hardware: China Components (Kyna Wong)

Shennan and Shengyi are top picks in China components

China's cloud service market, though much smaller than that of the US, is growing much faster than the US one, and is now the second-largest cloud service market globally. We see opportunities from rising server demand and product upgrades driven by public cloud. We also see significant demand for telecom-use PCB under the accelerated 5G rollout in China. PCB names benefit from both units and price hikes in 5G (the content in a single base station increases by almost four times). Content in front-/mid-/backhaul and core network equipment also increases on higher ASPs with the penetration of high-speed materials. Apart from telecom,

5G brings rising demand for high-frequency/high-speed PCBs in servers for data-centres. The new generation of servers means higher requirements for PCB, especially for high-speed and high-multilayer, which generate higher margins than telecom. We also see structural opportunities in domestic substitution with the increasing shares of China server vendors. Among China component names, PCB supply chain companies—Shennan and Shengyi—are expected to benefit from data-driven demand, with server exposure rising from 6%/10% in 2019 to 10-20%/10-15% revenue contributions by 2022. Of the two companies, our preference is for Shengyi.

Global Hardware: US Hardware (M Cabral)

For hardware vendors, the distinction between traditional on-prem and public cloud end-markets is critical. US OEMs have historically been highly exposed to the former, which is likely to face sustained pressure both near term from a softer IT spending backdrop and longer term as public cloud share gains accelerate, particularly in a post-COVID-19 world. While public cloud presents significant growth potential for hardware spending, the associated margin profile is too low to support OEMs' existing business models; we estimate GMs on servers sold to public cloud are likely in the high single digits vs. the 20%+ for enterprise demand. As a result, we view workloads shifting off-premises as a clear negative for traditional enterprise HW demand (servers, storage) as it shrinks the addressable market. That said, for those willing to look beyond near-term softness, we believe there's an opportunity for vendors in our coverage that embraces a hybrid-first approach and leverages their incumbency to drive consistency between customers' on-prem and off-prem environments.

IBM is our top pick in the US hardware sector

IBM is our top pick in the sector. We see the acquisition of Red Hat representing a landmark shift in strategy and creating an underappreciated opportunity to drive sustained revenue growth by bringing together the platform, incumbency and expertise necessary to help customers modernise the ~80% of applications that have yet to migrate to the public cloud. We also believe that NetApp's data fabric strategy is a key competitive differentiator and presents a compelling longer term opportunity to drive a storage-centric approach to hybrid cloud, driving share gains with both traditional on-prem and "born in the cloud" customers. We like Dell's positioning in a hybrid-first world (largely tied to VMware); however, we see pressure on "core" ISG and CSG in a weak macro coupled with outsized leverage that leaves little room for error. Finally, HPE remains over-indexed to on-prem demand, particularly servers at >50% of revenue, and lacks a compelling hybrid angle, in our view; its push towards 'as-a-Service' has gained good traction amid an increasing preference for opex > capex, but is still too small to offset pressure on its core business.

Asian Semiconductors: Foundry/Back-end/IC Design (Randy Abrams)

We expect advanced foundry and packaging to get a lift from high-performance computing chips (server, network processors, FPGAs, AI accelerators) which is driving higher demand on the advanced nodes at higher wafer pricing and also requiring advanced packaging and testing. Rising merchant silicon content and growing compute demand in this less price-sensitive segment is a positive counterbalance to cost pressures in mobile/consumer.

TSMC and Aspeed best leveraged in the Asian foundry, back-end and IC design space

TSMC and Aspeed have the highest leverage to the on-going data-centre build-out in our coverage. TSMC has doubled its HPC business to 30% of sales since 2016 and should maintain a teen CAGR with the growing opportunity in both AMD and China CPUs, AI accelerators (GPU, FPGA and ASIC) and 5G infrastructure processors, leveraging advanced manufacturing and wafer-level system integration. Aspeed has more than a 90% exposure to servers and is more indexed to hyperscale over enterprise (two-thirds of shipments) also with expansion into edge servers, storage and switching, and adding one more cloud customer. Aspeed is our preferred pick as it has corrected on short-term 2H digestion, but should have multi-year unit growth while TSMC may moderate from the 2020 strength factoring in Huawei, QCOM and NVIDIA headwinds.

Asian Semiconductors: IC Design Services (Randy Abrams/Haas Liu)

IC design service companies are leveraging semiconductor design capability and tight foundry relationships to supply system companies and emerging fabless design companies with design

support, bringing to market increasingly challenging and customised designs for high performance computing (HPC). Taiwan design services companies accelerated from being flat in the 2007-13 period to a +9% CAGR from 2013-19, and could further accelerate to 20% from a fast-growing pipeline of HPC (AI, 5G, server, PC and networking).

Alchip playing a key role in design service enabling supercompute, AI and China CPU makers

We believe Alchip, an IC design service company based in Taiwan with a strong R&D team in China and a focus on projects including HPC and AI on the advanced nodes, should benefit from the trend. The company's sales saw meaningful growth in 2019 supported by China CPU ramp for PC adopted by local governments and SOEs, and tape out of the AI project. We believe the company's sales should deliver a 30% CAGR from 2019-22 on more HPC and AI projects from its China and US customers. On the other hand, we are more conservative on GUC, the largest IC design service provider in Taiwan with its strong technology and capacity support across mature-to-advanced nodes from TSMC, as it needs to allocate some resources to legacy consumer customers—a segment which is only stable—offsetting some growth in AI and 5G. We expect the company's sales to see a solid 18% CAGR from 2019-22, with 30% GMs mainly driven by its customers' AI and 5G investments.

Global Semiconductors: US Semiconductors (John Pitzer)

NVIDIA, Intel, AMD, Micron and Xilinx best leveraged to the rising compute TAM

We estimate the semi market for compute (CPU, GPU, FPGA and APU) at ~US$90 bn growing to ~US$130 bn by 2025 (a 6% CAGR). Specifically, our top picks for companies most levered to this TAM are NVIDIA, Intel, AMD, Micron and Xilinx. The new data economy rests heavily on AI's ability to analyse the data being created at the edge and in the cloud in its unstructured form. NVDA currently has a significant share in HPC/AI applications, but other entrants are vying for share in the space (INTC and XLNX with FPGAs, AMD with GPUs, and potentially others down the line). Overall, we believe a rising tide lifts all boats in AI and all of these companies are positioned to benefit from the explosion in use cases. Whether in I/O, wired, networking, GPUs, or increasing demand for DRAM/NAND as complexity/workload increases, we continue to argue that investors and companies alike are underestimating the potential compute. AI in data centres fundamentally lowers the cost of analytics for the first time in history, which should unleash a very large wave of data analytics for TBD "killer applications".

Global Semiconductors: Memory (Keon Han, John Pitzer)

Memory is becoming a more valuable resource. Designs and specs are no longer defined and driven by more diversified usage; therefore, customisation enhances value. Similarly, hyperscalers no longer use OEM-built servers, but rather design their own for scale, profit optimisation and cost efficiency. As public cloud services become more dominated by hyperscalers, the rapid growth should drive a steady demand increase for server DRAMs, which have already grown to nearly 35% of the total DRAM market. Experiencing a faster demand growth rate vs. the mobile segment and having a short replacement cycle, server DRAM is expected to become the most valuable DRAM segment in 2-3 years.

Memory makers Samsung, Hynix and Micron benefiting from the importance and rising demand for data centre storage

Samsung, SK Hynix and Micron have high leverage to the on-going data-centre build-out. The CPU-to-memory ratio is balanced for optimal server performance and CPU core count, and the higher bandwidth and expanding number of memory channels continue to drive higher DRAM usage. An on-die error correction code requirement for DDR5 in order to detect and correct errors is a must and favours producers that are early to market. Finally, data centres (servers) are consumables that require replacement over a relatively short duration due to wear and tear from continuously running. New CPU generation that is more powerful and offers a competitive edge to customers' performance can compel faster replacement cycles. As a result of decades of industry consolidation, the remaining three DRAM makers stand to benefit well from this data-centre growth.

Global data-centre operators (Sami Badri)

Top US REIT picks are EQIX, DLR and SWCH

The US data-centre operators are directly tied to the growth of cloud computing and hybrid IT infrastructure by building the core, shell, and power and cooling that many private and public clouds reside in. multi-tenant data centres (MTDCs) are more cost effective for most customers as they can take up space as necessary, growing their IT infrastructure in line with their business. In recent years, interconnection and cloud on-ramps have proliferated in data centres,

increasing the value proposition of the data-centre ecosystem. Data-centre interconnection allows the direct connection of various tenants within the same MTDC to each other, which significantly improves throughput and decreases latency for customers. As cloud service providers have grown, they have increasingly used cloud on-ramps, which are points of presence within an MTDC that make it easy for tenants in a facility to connect into public cloud platforms. Cloud on-ramps provide an even greater incentive for enterprises to use MTDCs, drawing in enterprise clients, thereby aligning public cloud growth with MTDC growth. We highlight Equinix (EQIX), Digital Realty (DLR), and Switch (SWCH) as three well-positioned data-centre operators leveraged to the themes highlighted above.

China data centre operators (Colin McCallum)

GDS and VNET are our top China data centre operator picks

Data centre operators receive monthly rent from IT tenants which are their customers, based on the floor area occupied by the tenants and the power they consume. Crucially, the more servers which are required to support internet content, the higher the demand for data centres. As such, there is a very clear link between data centre demand and data volumes, which are rising rapidly. Furthermore, an increase in cloud computing by definition increases demand for internet storage facilities such as data centres. We estimate that in China, data centre construction is a value-accretive exercise, with an ROIC of 10.6-11.8% (based on utilisation of 85-98%), and so the faster the operators raise finance and construct capacity, the more value is created. We have OUTPERFORM ratings on both GDS and VNET, but an UNDERPERFORM rating on Dr.Peng. Following a sharp share price rally across the sector, GDS has most potential upside remaining and would be our top data centre pick.

China cloud operators (Tina Long, Kenneth Fong, Kyna Wong)

Kingsoft Cloud a new initiation benefiting from growth in China's public cloud market

China's public cloud market experienced exponential growth of 64% CAGR in the past five years, reaching US$7.5 bn (or Rmb50 bn) in 2018, according to IDC. Despite the rapid growth, China's public cloud market is still nascent, evidenced by the fact that cloud IT spending merely accounted for 3% of China GDP in 2018, half of that of the US. On the back of continued strong demand on internet verticals, multi-cloud deployment and traditional industries picking up steam in cloud deployment, China's cloud service penetration (cloud spending/IT spending) is expected to improve from 6% in 2019 to 15.8% in 2024. Other medium-term structural industry drivers include: (1) 5G, AI and IoT technologies applications, (2) overseas expansion on "Belt and Road" countries, and (3) policy support from the Chinese government.

Being the earliest mover in the cloud market in China a decade ago, AliCloud has spearheaded into the public cloud segment, and currently offers both IaaS (Infrastructure as a Service) and PaaS (Platform as a Service) to thousands of enterprises and government entities. As of 1Q19, it enjoyed a market share of 43% in China's public cloud market, the largest one with shares equating to the aggregation of No 2 to 7 players, based on data compiled by IDC. In our view, AliCloud is well positioned to benefit from the industry tailwind, with several key advantages.

Kingsoft Cloud (KC) is the largest independent cloud service provider in China, focusing on IaaS and PaaS, with its cloud solutions including both public and enterprise clouds. As of 2019, KC was ranked among the top 6 public service providers with ~5.4% market share in IaaS + PaaS in China, according to Frost & Sullivan. A few reasons why we like KC: (1) largest independent cloud service provider in China, (2) strategically selected verticals with high growth opportunities, (3) superior enterprise service capabilities with monetisation efficiency, and (4) strong technology capacities.

Sector Section

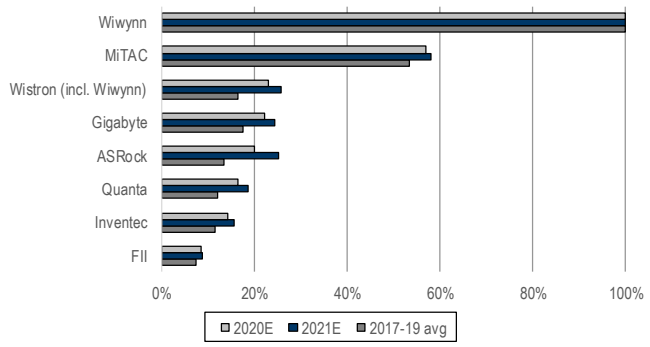
Asian Hardware: PCs and ODMs

Jerry Su
886 2 2715 6361

Harvie Chou
886 2 2715 6364

We believe that Asian cloud IT infrastructure ODMs have been key beneficiaries providing high-quality open-source hardware solutions with greater scalability on more competitive pricing that is preferable by cloud service providers. We believe Quanta and Wiwynn in server and enterprise storage, and Accton in Ethernet switching, are key beneficiaries from the increasing workload shift to the cloud; improving hyperscalers' capex cycle; and further proliferation of ODM Direct. We estimate 20-25% of Quanta's sales are from IT infrastructure equipment (70-80% for cloud scenarios), which has better margins versus notebooks and wearable products, while 100% of Wiwynn's sales are derived from cloud IT infrastructure equipment. For Accton, it joined the Facebook and Amazon supply chains in 2015, and we estimate data centre switch accounts for 35-40% of its total revenue.

Figure 154: Wiwynn and MiTAC have a higher sales exposure to cloud server



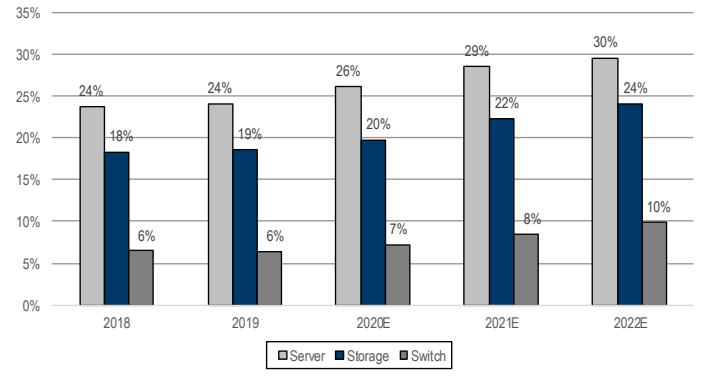
Source: Company data, Credit Suisse estimates

ODM Direct proliferation to continue in servers and switches with new opportunities

ODM direct in server and storage now at 30% and 24% penetration respectively

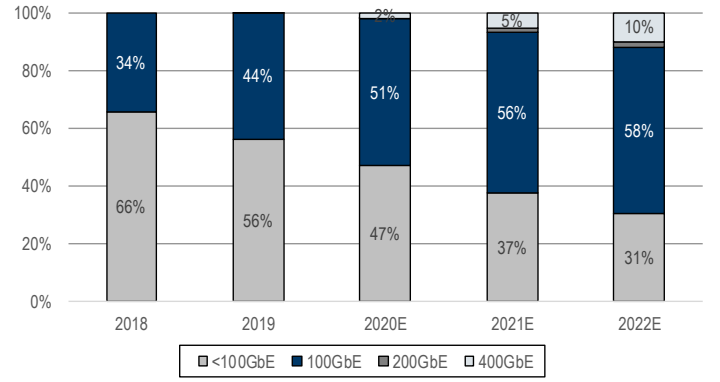
We expect ODM Direct proliferation in server/storage to continue, reaching 30% and 24% in 2022E, respectively, vs 24%/19% in 2019, and supported by the continued build-out of cloud data centres by the leading hyperscalers on the open-sourced platforms in order to meet the increasing cloud workload demand especially amid the COVID-19 outbreak. For networking switches, we expect ODM Direct to see a more meaningful take-off in the next few years, following the same patterns as in server/storage given the higher requirements for reliability and security, especially amid the migration from 100G to 400G. We expect ODM Direct penetration for data-centre switches to reach 10% in 2022, vs 6% as of the end of 2019.

Figure 155: ODM Direct proliferation to continue in server/storage; switch to also follow same pattern long-term



Source: Company data, IDC, IHS, Credit Suisse estimates

Figure 156: 400GbE speed port migration takes off from 2020 and is projected to reach 10% of the total market by 2022



Source: Company data, IHS, Credit Suisse estimates

400G could prove to have more competition between ANET, CSCO, JNPR and whitebox

According to CS networking analyst Sami Badri, the 100G cycle featured share gains for ANET against Cisco, and while early moves in 400G shipments may be encouraging for ANET, we highlight that we expect 400G to start shipping at scale in 2021. The upcoming 400G cycle could prove to be competitive due to more vendors, as ANET, CSCO, JNPR, and potentially whitebox vendors, all look to take market share.

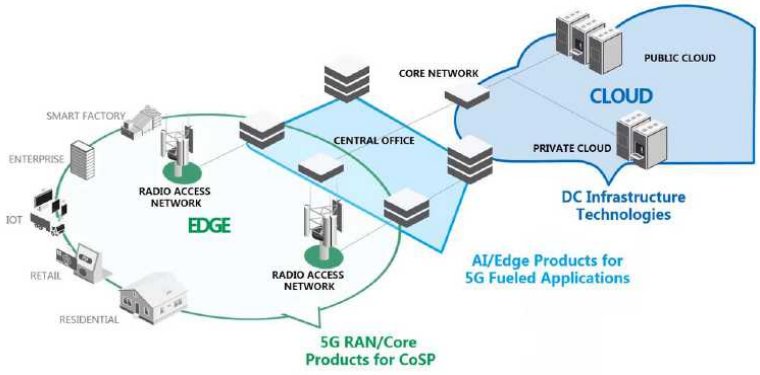
Furthermore, we believe that the 400G cycle should be more of a level playing field for three key reasons:

- Optics have become more standardised since the 100G cycle enabling vendors to lower costs faster;
- Most key players are using merchant silicon; and
- Vendors have been able to make adjustments to their operating systems with CSCO now using its new IOS XR7 networking operating system software and JNPR using its Contrail/Junos with SONiC integration.

The one key advantage ANET does have is its robust positioning in DCI/aggregation in dense Tier 1 nodes; however, in our view, this segment would not grow as fast as we have historically seen.

We expect Taiwan ODMs are set for a second wave of transformation from cloud to the edge on open-sourced platforms. We expect increasing engagement by Taiwan ODMs with telecom operators, first from Quanta with the collaboration announcement with Rakuten to build a cloud-native mobile network, as well as the ONAP machine-learning-based data lake project with China Mobile in 2019, while we expect other ODMs to also follow suit with more active engagement and R&D in the near term. However, based on our conversations, we expect the market opportunities to first be capitalised by carrier-premise IT infrastructure vendors, before the market take-off for Taiwan ODMs from 2021, supported by the proliferation of OCP OpenEDGE on enhanced total costs of ownership, as well as increasing sophistication in design and customisation by Taiwan ODMs. We believe this should drive better profitability in the long term, given the offering of more comprehensive 5G end-to-end hardware products and solutions (including on-premises uCPE, edge computing, 5G NR, 5G Core, and service assurance and applications) to telecom operators.

Figure 157: Taiwan cloud IT infrastructure ODMs set for a second wave of transformation from cloud to edge



Source: Wistron Wiwynn

For networking switches, we expect to see a more significant pick-up of 400GbE for cloud data-centre switches from 2H20, from the current mainstream port speed of 100GbE, and for this to further increase in 2021-22 as the cost structure of the transceivers, chipsets, etc., further improves. According to IHS, 400GbE sales are expected to further scale, representing more than 10% of total market sales in 2022, vs 2% in 2020. We also expect sales from ODM Direct in this segment to pick-up more significantly for nearly 20% of the market shares in 400GbE by 2022, vs 1% and 5% in 2019/20, respectively.

Top picks in Taiwan ODMs: Quanta and Wiwynn; Accton/Parade preferred names but limited upsides

We believe Taiwan IT infrastructure ODMs are the key beneficiaries from the continued expansion of global cloud spending by the leading US based hyperscalers, supported by further proliferation of OCP, and Taiwan ODMs leadership on the open-compute platform, as well as their respective long-standing hardware design/manufacturing know-how and global after-market services support. In this space, Quanta (NT$90.0 TP) is our top-pick among Taiwan ODMs, as we believe it will maintain its leading position on more diversified customers base, and earlier progress into enterprise/telco, driving enhanced profitability long-term. We also believe Accton (NT$240 TP) will be key beneficiary from the open-sourced platform take-off in networking switch, along with 400GbE speed-port migration, as well as new opportunities in 5G telco, but we see limited upsides after the over-100% run YTD.

We initiate coverage on Wiwynn with an OUTPERFORM-rating and NT$960 TP (over 20% upside), as we expect it to see the largest momentum uplift from cloud IT infrastructure demand uptick, as the only pure play cloud IT infrastructure ODM with also unique positioning with the US hyperscalers, aside from new customer ramp from May-2020. Lastly, we also believe Parade (NT$970 TP) to benefit on PCIe4 take-off in data-centre and its technology leadership in high-speed IC, but also believe valuation becomes overly stretched after over 100% appreciation YTD.

Initiating on Wiwynn with Outperform

Asian Hardware: Components

Pauline Chen
886 2 2715 6323

Angela Pan
886 2 2715 6352

Market opportunity for the group

Silicon scaling limitations, exponential data processing, broader machine learning frameworks, on-device intelligence and 5G adoption, have led to significant design changes for hardware components. How to deal with high bandwidth, low latency and massive connectivity, while meeting cost efficiency, is also important, given the huge ASP increase due to design changes and an estimated 40% of electrical power used to cool down a data centre. We expect the above trend to provide a growth opportunity for the components sector, which includes high-speed/high-frequency design and better thermal dissipation technology.

Supply chain implications

Components seeing opportunity across PCB, power supply, thermal and connectors

PCB: The PCB sector benefits from a material change (CCL and FPC) to deal with high-speed and high-frequency requirements, which comprise at least a double-digit increase in ASP. Board makers also see benefit from the layer count increase, large area size and more usage of ABF substrate type compared to BT substrate type in data centres. Key suppliers have been adding capacity to meet demand growth and yield rate loss.

Power supply: Efficient power distribution and heat dissipation become more crucial, given more power consumption in HPC. With a 3,000+ Watt design becoming the mainstream for server power supply, power usage effectiveness (PUE) is also critical for total data-centre operating costs. We expect the change to be ASP accretive for leading suppliers, i.e. Delta, but we will monitor the progress of AI data centres, as these might theoretically reduce the number of servers required per data centre.

Thermal: Better heat dissipation in data centres requires new thermal and casing design. Liquid cooling is seeing greater adoption in data centres, compared to other applications, i.e., PCs, NBs, smartphones and game consoles. Suppliers with better integration of different knowhow (including thermal, fans, casing material, etc) are likely to be better positioned, in our view.

Connectors: The connector sector benefits from more pin counts, due to faster transmission speeds and massive connectivity, which is ASP accretive. The adoption of DDR5 and PCIe Gen4 could also lead to a design change from DIP to SMT, which also boosts ASP.

Stock outlook

Delta Electronics (2308 TT): We believe Delta's core competence in highly efficient power electronics and its rich product offerings (including server power supply, telecom power supply, cooling, power chokes and networking, etc) should continue to help the company stay ahead in the power/energy efficiency competition.

FII (601138 SS)/Hon Hai (2317 TT): We expect FII/Hon Hai to gain market share in the fast- growing cloud market, thanks to its share gains in cloud service provider (CSP). While FII's CSES generates a lower-than-peer GM (4% in 2019, vs. Wiwynn's 6.9%), due to its higher exposure to enterprise customers, we expect its continued market share gains in CSP **US** (especially Microsoft) to drive margin improvement in CSES over 2020-21E.

Asian Hardware: China Downstream

Public cloud driving server demand

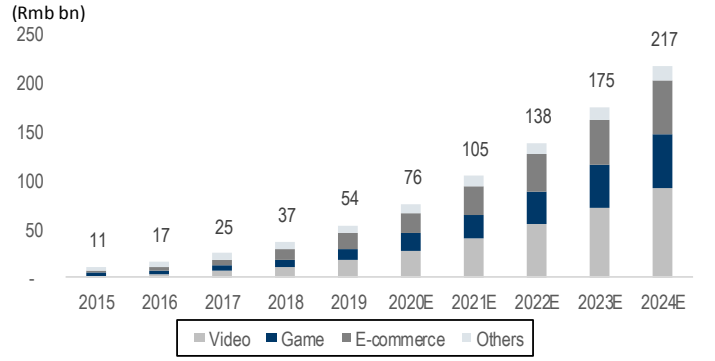
Kyna Wong
852 2101 6950

Stephen Yin
852 2101 6980

Clive Cheung
852 2101 7069

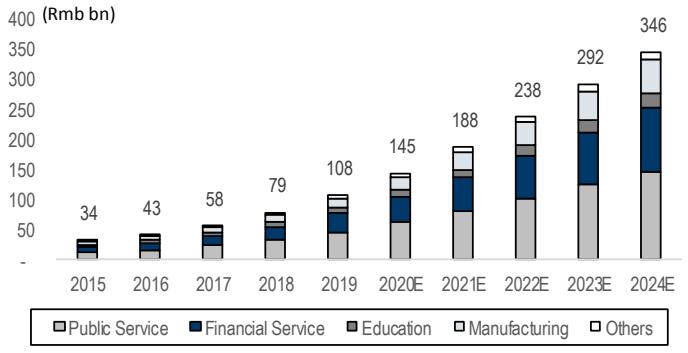
China's cloud service market size is much smaller than that of US, but the cloud service growth rate is much faster and it became the second-largest cloud service market globally in 2018 according to Frost & Sullivan. Overall, we see that China's cloud penetration is about 5-6 years behind that of the US. However, with faster growth, we expect China's cloud service penetration to gradually reduce the gap with the US. China's internet cloud market is expected to reach Rmb217.5 bn in 2024, with a CAGR of 32.2% from 2019-24E. Among the internet vertical, video and games have the fastest CAGRs, followed by e-commerce. According to Frost & Sullivan, almost half of US traditional enterprises and public service organisations were using cloud services in 2019, but only 10.5% of those in China are doing the same. With increasing acceptance of cloud services among traditional enterprises, we expect fast growth in cloud services among these verticals, especially led by financial services and manufacturing, with 28.1%/28.4% CAGRs from 2019-24E in terms of market size in China.

Figure 158: A 32.2% CAGR for China's internet cloud service market from 2019-24



Source: Frost & Sullivan, Credit Suisse

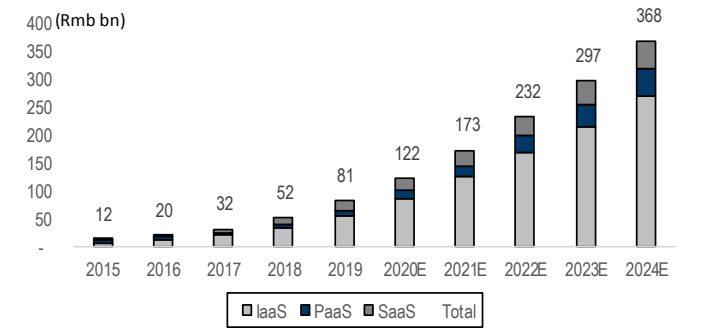
Figure 159: A 26.2% CAGR for China's cloud market for enterprise and public service organisations from 2019-2024



Source: Frost & Sullivan, Credit Suisse

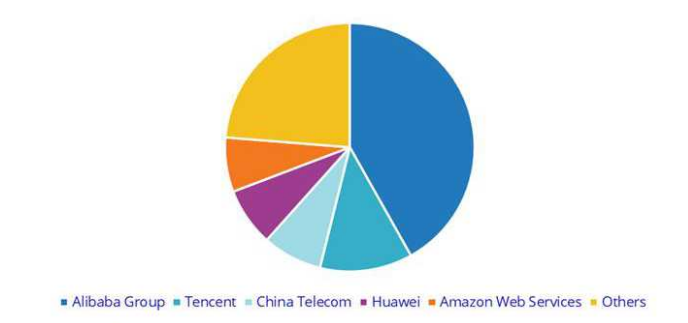
Compared with the US, China's public cloud market is driven by Infrastructure as a Service (IaaS), with an 87% contribution in 2019 with a continued high 36.8% CAGR for 2019-24E. Typical cloud service providers in China usually start with IaaS, renting cloud servers instead of building their own. Secondly, some of them engage in PaaS, while moving databases onto cloud servers. Eventually, they undertake first trials on the cloud version of the software (SaaS) which they have already used. PaaS and SaaS are still in their early stages in China. Cloud service providers intend to promote PaaS to lift customers' loyalty.

Figure 160: IaaS accounts for a majority of China's public cloud market



Source: Frost & Sullivan, Credit Suisse

Figure 161: Top-5 IaaS + PaaS players in China's public cloud market in 2H19



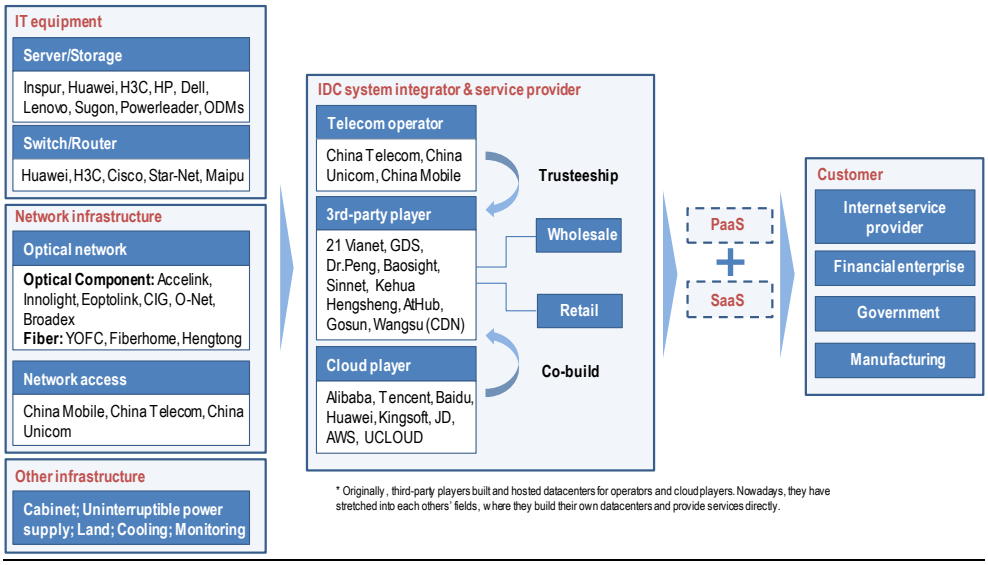
Source: IDC

For public cloud, Alibaba (~40%), Tencent (~11-12%), China Telecom (7.6%), and Huawei (~7.5%) hold established positions, while the fifth player is Amazon (~6%), which has just overtaken Baidu in 2019. Alibaba and Tencent started with a large amount of SMEs with low ARPU and loyalty, while China Telecom and Huawei had higher exposure to large enterprises (including SoEs) and operators. Huawei grabbed market share with its offline channel and implementation capabilities, starting end-2017 in public cloud. For private cloud, the market is fragmented, but we believe Huawei ranked No. 1, followed by H3C/Inspur ranked No. 2/No. 3.

China public cloud led by Alibaba, Tencent, China Telecom and Huawei

In the value chain of public cloud, we see cloud service providers also working with internet data centre operators (IDC). Telecom operators are the largest IDCs in China, followed by some independent service providers such as GDS, 21Vianet, Sinnet, etc. The giant cloud service providers, such as Ali-Cloud, Tencent Cloud and Huawei Cloud would build their own IDCs, instead of leasing or renting. Alibaba said it would invest Rmb200 bn (US$28 bn) in its cloud infrastructure over three years. Tencent is also set to invest around Rmb500 bn (US$70 bn) over the next five years to launch an array of advances in cloud computing as well as other technological offerings.

Figure 162: Value chain of China's public cloud industry

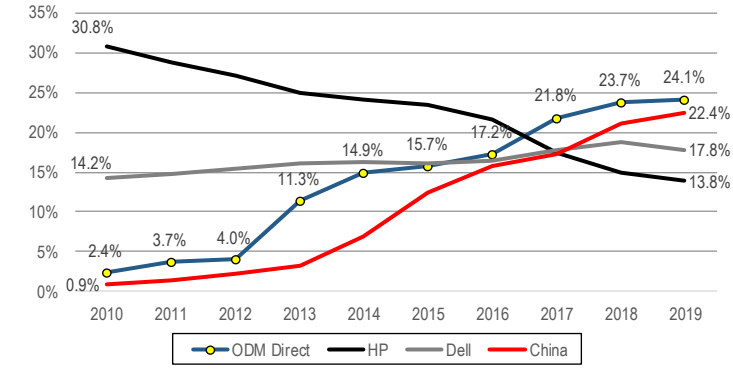

IT equipment
Server/Storage
Inspur, Huawei, H3C, HP, Dell, Lenovo, Sugon, Powerleader, ODMs
Switch/Router
Huawei, H3C, Cisco, Star-Net, Maipu
Network infrastructure
Optical network
Optical Component: Accelink, Innolight, Eoptolink, CIG, O-Net, Broadex
Fiber: YOFC, Fiberhome, Hengtong
Network access
China Mobile, China Telecom, China Unicom
Other infrastructure
Cabinet; Uninterruptible power supply; Land; Cooling; Monitoring
IDC system integrator & service provider
Telecom operator
China Telecom, China Unicom, China Mobile
3rd-party player
21 Vianet, GDS, Dr.Peng, Baosight, Sinnet, Kehua Hengsheng, AtHub, Gosun, Wangsu (CDN)
Cloud player
Alibaba, Tencent, Baidu, Huawei, Kingsoft, JD, AWS, UCLOUD
Trusteeship
Wholesale
Retail
Co-build
PaaS
SaaS
Customer
Internet service provider
Financial enterprise
Government
Manufacturing
* Originally, third-party players built and hosted datacenters for operators and cloud players. Nowadays, they have stretched into each others' fields, where they build their own datacenters and provide services directly.

Source: Company data

We see opportunities from rising server demand and product upgrades driven by public cloud. The increment of servers mainly comes from cloud, which has expanded rapidly over the past few years. After an aggressive pull-in in 2018, overall capex spending from the global tier-1 hyperscalers slowed materially in 2019, while we are now seeing improving server momentum on hyperscalers' rebounding capex spending. The aggregated capex spending of tier 1 cloud vendors—including Facebook, Google, Amazon and Microsoft in the US, and Baidu, Alibaba and Tencent in China—amounted to US$78.9 bn in 2019 with growth of 2.1% YoY. Cloud capex has started to recover from 4Q19 and we expect the momentum to continue into 2021. CS tech team forecasts total hyperscale capex is set to rebound from -5% YoY and US$96 bn in 2019 to +17% and US$112 bn in 2020, with a further +17%/6% in 2021/22.

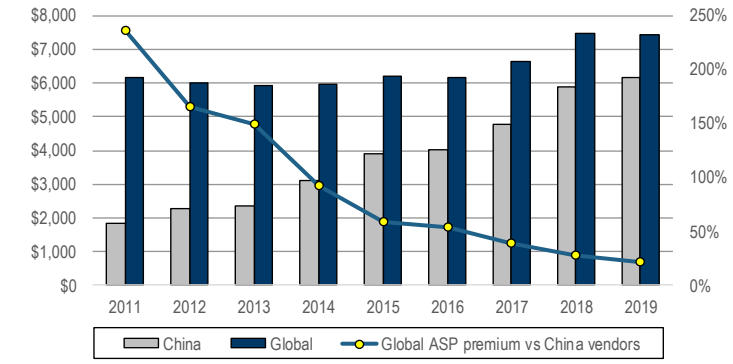
According to IDC, despite rising penetration of ODM Direct, China server vendor (Inspur, Lenovo, Huawei, H3C and Sugon) shares delivered a 34% CAGR in the global market over 2014-18. Their shares increased even more by over 10 pp domestically from 2014-18 to represent over 60% of total shares. Among all the shipments made by the China vendors, the majority are volume servers with an average selling price of less than US$25,000 based on IDC definition, but China vendors are also gaining shares in mid- to high-end servers as the premium of global ASPs over China has been decreasing to slightly more than 20% by the end of 2019.

Figure 163: China server vendors gain share despite the rising share of the ODM Direct model



Source: IDC, Credit Suisse

Figure 164: Global x86 server premium vs China decreasing to slightly more than 20%



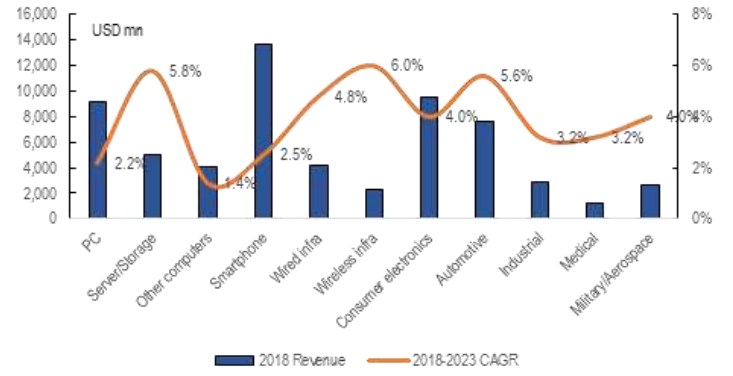
Source: Company data, Credit Suisse

Market opportunities for China's PCB supply chain

According to Prismark, the server/storage sector CAGR is expected to reach 5.8% over 2018-23, second only to wireless telecom infrastructure's 6.0%. The new generation of servers means higher requirements for PCBs, especially for high-speed and high-multilayer, which generate higher margins than telecom. Server and telecom PCBs have similarities in technology and customer. We believe that SCC and Shengyi would benefit from the upcycle in the server market.

SCC and Shengyi benefiting from multi-layer and higher speed requirements for PCBs

Figure 165: PCB market CAGR for 2018-23 by application



Source: Prismark, Credit Suisse

Figure 166: Server upgrade requires high-speed CCL

Standard	Speed	Material	Product	Server	Status
PCIe Gen 3	8Gbps	Mid	IT-170GRA1	Intel Purley Platform	Continue winning new qualifications and shipment
PCIe Gen 4	16Gbps	Low	IT-858G	Intel Whitley Platform AMD Rome Platform	Start shipment in 3Q19
PCIe Gen5	32Gbps	Super Ultra Low	IT-968 IT-968G	Intel Eagle stream Platform	Cooperate with customer for PCB design and material test
Standard	**Speed**	**Material**	**Product**	**Switch**	**Status**
NRZ	28Gbps	Ultra Low	IT-968 IT-968G	100G Switch, high end router	Continue shipment
PAM-4	56Gbps	Super Ultra Low	IT-988G SE	400G Switch, high end router	Qualifying with end customer

Source: Iteq, Credit Suisse

We see very large demand for telecom-used PCBs under the accelerated 5G rollout in China, where we forecast 613k/885k/1,021k BTS shipments over 2020-22E. PCB names benefit from units and price hikes in 5G due to content in single BTS increasing by almost 4x, in addition to there being 1.1-1.5x the shipments of 4G BTS. Content in front-/mid-/backhaul and core network equipment also increases on higher ASPs with the penetration of high-speed materials. Apart from telecom, 5G brings rising demand for high-frequency/high-speed PCBs in server/IDC and vehicle electronics. The new generation of servers means higher requirements for PCBs, especially for high-speed and high-multilayer, which generate higher margins than telecom. We also see structural opportunities in domestic substitution, with the increasing shares of China server vendors.

PCBs seeing a 4x content increase moving from 4G to 5G

As the communication industry enters the 5G era, there are higher requirements for data traffic and transmission speed. Some 90-95% of servers are based on Intel's x86 framework. It is estimated that Intel will move to the new generation of server platform by end-2020, and computing performance would be further enhanced. According to our company checks, the penetration rate of Intel's Purley Platform (PCIe 3.0) is expected to increase from 80% in 2019

to 90% in 2020. The remaining share of servers is dominated by AMD, whose Rome Platform (PCIe 4.0) kicked off in 3Q19, while PCIe 5.0 was released in June 2019 with 4x the speed of the current PCIe 3.0. As a result, we see rising demand for high-speed PCB/CCL to satisfy this round of server upgrades.

Our industry checks show that PCB accounts for c. 5% in the cost of IDC. Assuming that the average PCB GM is 20%, raw materials take up 60% of COGS, and CCL takes up 50% of material cost, that is, CCL's market value is equal to 24% of the PCB. Based on this above assumption, we estimate CCL demand in IDC would reach Rmb6.2/6.6/7.2 bn in 2020-22E, of which high-speed CCL would be Rmb3.4/4.0/4.6 bn.

Top picks: Shengyi

Among China component names, we note that PCB supply chain stocks Shennan and Shengyi should benefit from data-driven demand with server exposure of 6%/10% in 2019 rising to 10-20%/10-15% revenue contributions by 2022. Telecom remains the major driver given its more than 65%/30% contributions in Shennan/Shengyi, respectively. Data centre requires high-frequency and high-speed CCL, which should drive further domestic substitution given rising China server production and the urgent need for supply chain security.

- **Shengyi (OUTPERFORM, TP Rmb48.** As a leading PCB/CCL maker in China, Shengyi shall realise volume and price improvement from the promising demand from telecom, datacom and automotive. Its profitability will improve thanks to the product mix upgrade with penetration of high-frequency and high-speed and improvement of operation efficiency. We model NI to grow by 33%/29%/23% in 2020-22E, supported by 20% CAGR of revenue and GM improvement. Our TP of Rmb48.1 is based on 2021 EPS and 44x P/E (+0.5SD of A-share CCL peers five-year historical average) and it is at c.15% premium of the simple average of A-share peers with 28% NI CAGR and 20% ROE.
- **Shennan (NEUTRAL, TP Rmb194.6):** We like Shennan due to it being a leading PCB maker with comprehensive capabilities. It should achieve sustainable growth driven by 5G, server and IC substrate. We like its leadership in telecom PCB and ramping IC substrate business, but near-term ASP pressure in 5G BTS PCB is an overhang and we await a better entry point. We model NI to grow by 43%/23%/11% over 2020-22E, supported by improving revenue and profitability. Our target price of Rmb194.6 is based on 2021 EPS and 43x P/E which is in line with +1SD of its A-share PCB peers' five-year historical average, and supported by 24% NI CAGR and 31% ROE in 2021.

CREDIT SUISSE

Asian Semiconductors: Foundry/Backend/IC Design

TSMC is the key beneficiary on its technology leadership

Randy Abrams
886 2 2715 6366

Haas Liu
886 2 2715 6365

The foundries historically were underexposed to the high-performance computing market, as server processors with a high portion of silicon opportunity have been dominated by Intel fabbing the CPUs itself. We believe that TSMC is the key beneficiary in the growing data centre market for its strong technology roadmap supporting its high-performance computing customers migrating to the most advanced nodes compared with its peers'. For TSMC, the high-performance computing market has been more related to graphics, programmable logic chips (FPGA) from Xilinx/Altera and network processors. With TSMC's technology now advancing to 5nm along with its customers' ambitions to replace CPU in some use cases (e.g. AI server), the company is turning more competitive in the applications requiring better performance compared with Intel's 14nm and upcoming 10nm, with AMD targeting a 15% server market share in addition to its growing traction in the PC/NB market. China's initiative on replacing overseas CPU with domestic solutions for better technology control would also support TSMC's growth potential in the HPC market.

Figure 167: TSMC growing its business 22% in 2022, led by its HPC opportunities

TSMC growth drivers	2016	2017	2018	2019	2020	2021	18-21 CAGR
HPC - TSMC	$6.1	$8.1	$10.9	$10.3	$13.6	$14.1	9%
HPC - Market	$19.3	$22.5	$26.1	$26.2	$29.5	$32.0	7%
TSMC share (%)	**31.7%**	**36.1%**	**41.9%**	**39.3%**	**46.0%**	**44.1%**	
Automotive - TSMC	$1.3	$1.4	$1.7	$1.5	$1.46	$1.6	-2%
Automotive - Market	$10.8	$12.2	$13.4	$14.5	$16.1	$17.9	10%
TSMC share (%)	**12.4%**	**11.4%**	**12.7%**	**10.6%**	**9.1%**	**9.0%**	
IoT - TSMC	$1.7	$1.8	$2.1	$2.68	$3.1	$3.39	18%
IoT - Market	$5.6	$7.3	$9.0	$11.4	$14.2	$17.6	25%
TSMC share (%)	**29.7%**	**24.8%**	**22.7%**	**23.6%**	**21.6%**	**19.2%**	
Mobile - TSMC	$15.1	$16.3	$15.6	$16.9	$20.3	$21.0	10%
Mobile - Market	$30.9	$31.3	$30.7	$30.5	$35.1	$39.9	9%
TSMC Mobile share (%)	**48.9%**	**51.9%**	**50.9%**	**55.3%**	**57.8%**	**52.8%**	
Digital Consumer	$2.6	$2.5	$2.3	$1.8	$2.1	$2.1	-3.5%
Other	$2.6	$2.0	$1.6	$1.4	$1.9	$1.6	
TSMC CS Estimates	**$29.4**	**$32.1**	**$34.2**	**$34.6**	**$42.4**	**$43.8**	**8.6%**
YoY Growth	**10.6%**	**9.1%**	**6.5%**	**1.3%**	**22.5%**	**3.2%**	

Source: Company data

TSMC gaining more opportunity in HPC applications through AMD and China CPUs, FPGA, AI accelerators and network processors

We estimate TSMC's has doubled its high performance computing business from US$6 bn in 2016 to US$12.6 bn in 2020, with key drivers including its dominant position in graphics and accelerators for AMD and NVIDIA. The company's FPGA and network business is also growing along with rising investment in data centres and AI. We estimate the company's high performance computing business to grow 5-10% YoY in 2021, following +20-25% in 2020, with drivers including:

AMD's continued ramps. AMD shifted its server and desktop platforms from GlobalFoundries' 14nm to TSMC's 7nm starting from 3Q19 and continued that migration to 7nm in 1Q20. TSMC is gaining share at an opportune time as AMD is also growing its share from a low base across server and desktop/notebook compute with a more competitive product line in part from its support now having access to more advanced capacity.

For TSMC, we project its contribution from AMD based on consensus revenue growth for AMD to increase from US$1.5 bn in 2018 to US$3.9 bn by 2021, taking it from a 4-5% customer to a 9% customer at the end of the period. An upside case for AMD taking a 15% market share in servers, desktops and notebooks similar to its 2006 peak would bring that stream up to US$5.3 bn, providing further 4-5 points of upside to TSMC's sales growth.

New game console cycle. In addition to the CPU opportunity, AMD is also ramping up new game consoles, with TSMC manufacturing the CPU and GPU on 7nm.

Figure 168: TSMC's HPC business has grown at an 18% CAGR from 2015-20

HPC Silicon Market	2015	2016	2017	2018	2019	2020	2021	15-20 CAGR
Servers and CPUs	$14.4	$15.4	$16.8	$20.6	$22.6	$24.8	$27.3	11%
Graphics and Gaming	$7.1	$8.4	$10.9	$13.0	$12.4	$14.4	$15.5	15%
AI Accelerators	$0.34	$0.8	$1.9	$3.5	$4.0	$6.4	$9.0	80%
Cryptocurrency	$0.3	$0.4	$2.5	$3.3	$1.0	$2.0	$2.0	NM
Programmable Logic	$4.4	$4.3	$4.5	$4.7	$5.4	$5.8	$6.2	6%
Networking & Infrastructure	$13.0	$13.2	$14.1	$14.6	$15.6	$17.18	$18.04	6%
Computing Peripherals	$8.0	$7.8	$7.7	$7.5	$7.4	$7.2	$7.1	-2%
HPC - Market	**$47.5**	**$50.4**	**$58.5**	**$67.3**	**$68.3**	**$77.8**	**$85.1**	10%
HPC Wafer Opportunity	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**15-20 CAGR**
Servers and CPUs	$6.5	$6.9	$7.6	$9.3	$10.2	$11.2	$12.3	11%
Graphics and Gaming	$2.7	$3.2	$4.1	$4.9	$4.6	$5.4	$5.8	15%
AI Accelerators	$0.1	$0.2	$0.4	$0.8	$0.9	$1.4	$2.0	80%
Cryptocurrency	$0.2	$0.2	$1.3	$1.7	$0.5	$1.0	$1.0	NM
Programmable Logic	$1.0	$1.0	$1.1	$1.3	$1.5	$1.6	$1.7	9%
Networking & Infrastructure	$4.4	$4.5	$4.8	$4.9	$5.3	$5.8	$6.1	6%
Computing Peripherals	$3.4	$3.4	$3.3	$3.2	$3.2	$3.1	$3.0	-2%
HPC - Market	**$18.2**	**$19.3**	**$22.5**	**$26.1**	**$26.2**	**$29.5**	**$32.0**	10%
TSMC estimates (CS)	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**15-20 CAGR**
Servers and CPUs	$0.0	$0.0	$0.0	$0.3	$0.5	$1.3	$2.1	NM
Graphics and Gaming	$2.0	$2.0	$2.4	$3.7	$3.6	$4.3	$3.6	16%
AI Accelerators	$0.1	$0.2	$0.4	$0.8	$0.9	$1.4	$1.9	78%
Cryptocurrency	$0.1	$0.2	$1.3	$1.6	$0.4	$0.7	$0.6	NM
Programmable Logic	$0.7	$0.7	$0.7	$0.9	$1.1	$1.2	$1.3	12%
Networking & Network Processors	$1.6	$1.6	$1.8	$2.0	$2.2	$2.6	$2.74	10%
Computing Peripherals	$1.4	$1.4	$1.4	$1.7	$1.7	$2.06	$2.0	8%
HPC - TSMC	**$5.9**	**$6.1**	**$8.1**	**$11.0**	**$10.3**	**$13.6**	**$14.1**	18%
TSMC share of HPC production	**32%**	**32%**	**36%**	**42%**	**39%**	**46%**	**44%**	

Source: Company data

Good growth in network processors and FPGAs. The FPGA and network processors could see accelerating growth from the rising content in 5G base stations which requires additional compute by the cell site and also as accelerators in the data centre, with Xilinx expecting its served available market expanding at a 16% CAGR over FY20-24 (Mar) from US$15 bn to US$28 bn. We expect Xilinx to continue the partnership with TSMC's technology migration in the leading edge.

Growth of AI accelerators. We believe NVIDIA's AI accelerator business is broadening to more companies developing own machine-learning and inference chips (Huawei, Alibaba, Amazon, Google, AMD and Xilinx and a host of start-ups).

China CPUs is an emerging channel for TSMC given its process lead over the local foundries

Potential compute business in China. China may provide another channel for server demand from its efforts to diversify from the US and have its own hardware and security software. Huawei introduced its Kunpeng 920 server CPU fabbed at TSMC claiming high bandwidth, I/O count and the most processing capability among the nascent ARM-based server chips. Alibaba also went to TSMC design service partner Global Unichip for its Hanguang 800 AI chipset built in TSMC. China fabless is developing their own CPU solutions to replace Intel/AMD for government and SOE (e.g. Phytium) and also working with IC design service companies and manufacture at TSMC.

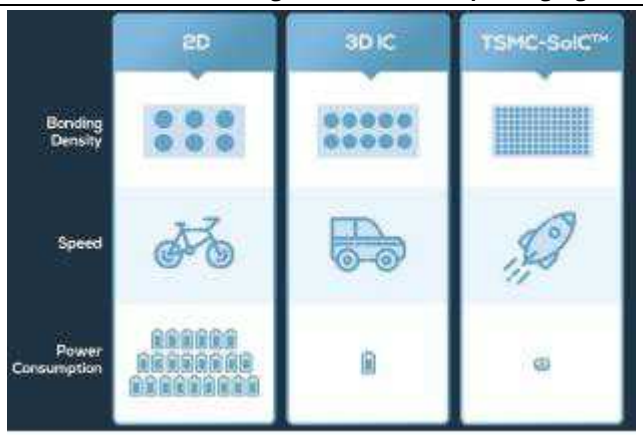
Although SMIC may get support from local government on funding, we believe the company will still be less competitive compared to TSMC in the most leading edge applications requiring high-performance computing, as the company is lagging in technology roadmaps by three generations (5-10 years) and lacks the most advanced manufacturing tool access (e.g. EUV).

ASE/Amkor also targeting high performance compute

While TSMC's back-end contribution is US$2.8 bn (8% of the company's sales), modest relative to the overall company due to the large scale of front-end wafer fabrication, we believe the business is a key growing piece in TSMC's strategy to sustain leadership. The company is advancing solutions to combine front-end foundry and advanced packaging to extend Moore's Law for its customers particularly in high performance computing, high-end mobile and advanced autonomous driving, with back-end technologies including InFO (integrated fan-out—

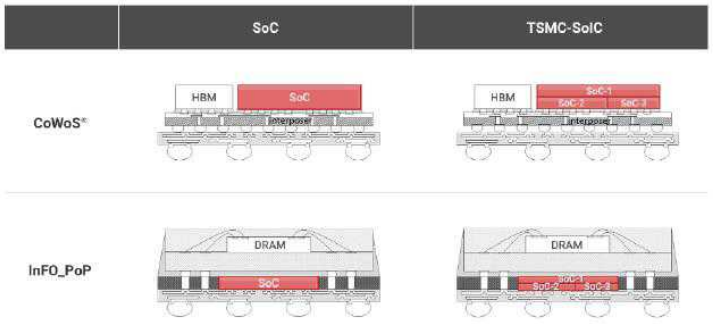
redistribution layer in compound to package chips), CoWoS (chip on wafer on substrate—silicon interposers to connect chips) and SoIC (system on integrated chips—3D stacking to connect chips). TSMC has good traction in the business with 60 tape-outs for its CoWoS as of 2H19 with design wins at high-performance computing applications including FPGA (Xilinx), graphics (NVIDIA), networking (Broadcom and Mediatek), supercomputing (Fujitsu) and China CPU fabless (Phytium, Kunpeng) and 20 tape-outs for InFO with solutions for networking, mobile, AiP and wearables, and the high-profile iPhone design since 2016.

Figure 169: TSMC believes its SoIC offers better power performance versus existing 2.5D and 3D IC packaging



Source: Company data

Figure 170: TSMC's back-end solutions include InFO, CoWoS using silicon interposer and SoIC using advanced 3D stacking



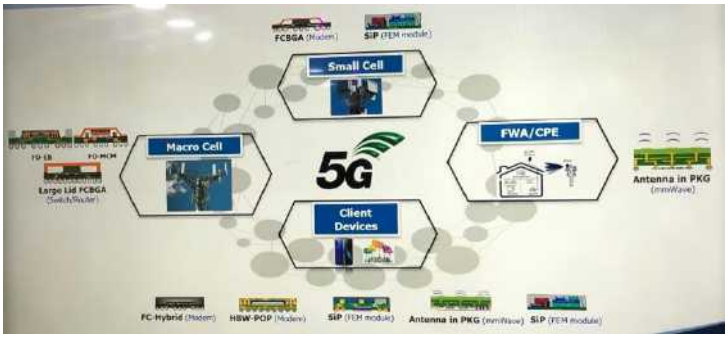
Source: Company data

For the pure back-end companies, although the dollar content for high-performance computing is high, the volume opportunity is relatively low so the opportunity may be on the edge computing devices. We believe that ASE and Amkor's computing business contributes 15% of its sales. The company in the core computing business should benefit from the applications including graphics and game consoles (AMD, NVIDIA) and networking chipsets while it can also leverage its strong SiP business in the edge computing business for 5G and RF content growth in end devices.

Figure 171: Powertech has introduced its fan-out roadmap

Source: Powertech

Figure 172: ASE and SPIL facilitate 5G networking packaging



Source: ASE

IC Design: Aspeed a near pure play, Mediatek has growing exposure with its ASIC solutions

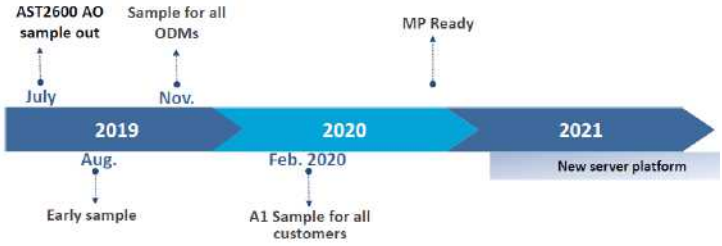
Aspeed has been dominant in its core baseboard management controllers (BMC) that comprise 90% of sales, with a 70% market share. The company supplies almost all of the major hyperscale customers through the Taiwan ODMs and has grown to a 35% enterprise server share following its acquisition of Broadcom's Emulex Pilot division in 2H16. Although the business may slow down in the near term due to inventory overbuild in 1H20, we believe the company has drivers in 2021 including share gains in new cloud customers by 2H21 and more units into storage, switch and 5G Edge servers (incremental 5-10% of units). Some data-centre capex would also be deferred due to lockdown constraints this year.

Aspeed has a 70% share of server units with its Baseboard Management Controller for remote management of servers

For Mediatek, the company's subsidiary, Nephos, was set up in 2012 for the company's networking switch business with a focus on enterprise Ethernet switch chips. We believe the high-end data-centre switching business should grow as customised chipsets are penetrating into Cisco and Juniper following the company's investments in the past few years. The company has several design wins, including a tier 1 OEM with its high-end Serdes data centre switch operating at 56Gbps, with 112Gbps in development and tape-out on TSMC's 7nm. The market size is about US$2 bn+—dominated by Broadcom followed by Marvell, both operating at 60%+ GMs—and offers good potential for new entrants. The key for Mediatek in data centre switching, is maintaining time-to-market for these data centre upgrade cycles with much attention devoted to hitting the 5G market on time.

Mediatek established its networking subsidiary and ASIC team to target data centre switch and AI acceleration projects, opening up a US$2 bn+ new market opportunity at higher margins than consumer and mobile

Figure 173: Aspeed's AST2600 BMC to be in mass production by the year-end



Source: Aspeed

Figure 174: Nephos provides a complete product portfolio with unified architecture to support higher capex efficiency

Source: Nephos

Asian Semiconductor: IC Design Services

Haas Liu
886 2 2715 6365

IC design service companies are benefitting from a trend for rising IC design difficulty as technology migrates, with the design cost surging from US$26 mn for 28nm to US$52mn for 16nm and US$130mn for 7nm. To ensure successful tape-out and secure foundries' capacity, design service companies can fill a gap supplying design support and foundry design-in to system companies and start-ups designing chipsets on the advanced nodes. The trend for IC customisation and higher design cost has accelerated the growth for major Taiwan IC design service companies with a 9% CAGR from 2013-19, in line with global fabless, following a slow 2007-13 (1% CAGR vs. global fabless' 9%) when the market was dominated by standardised chipsets (e.g. main processors in PCs and smartphones).

Figure 175: Performance, technology and target application comparison for major IC design service companies

IC design service company	Global Unichip	Alchip	Faraday	VeriSilicon
Ticker	3443.TW	3661.TW	3035.TW	Pending
Revenue (US$mn)	$346	$140	$172	$191
GMs	27.5%	35.6%	44.6%	40.2%
OpMs	6.5%	10.0%	7.5%	-4.7%
Headcounts	759	404	882	936
Service	Front/back-end design, IP	Front/back-end design, IP	Back-end design	Front/back-end design, IP
Technology support	**65nm and above:** 30% **40nm:** 13% **28nm:** 37% **16nm:** 16% **7nm and below:** 4%	**55nm and above:** 4% **40nm:** 6% **28nm:** 29% **20/16nm:** 33% **12/7nm:** 27%	**0.25um:** 0-5% **0.18-0.11um:** 35-40% **90-55nm:** 20-25% **40nm:** 15% **28nm and below:** 20-25%	**28nm and below:** 85% **28nm and above:** 14%
Targeted applications	**Computer:** 43% **Consumer:** 34% **Communication:** 11% **Others:** 12%	**HPC:** 59% **Network:** 14% **Niche:** 18% **Consumer:** 9%	**Industrial:** 30-35% **AIoT:** 30-35% **Communication:** 20% **PC:** 10-15% **Others:** 0-5%	**Consumer:** 38% **IoT:** 24% **Data processing:** 20% **Industrial:** 10% **PC:** 4% **Automotive:** 4%
Foundry partners	TSMC (100%)	TSMC (~100%), Samsung, SMIC, GlobalFoundries	UMC (70-75%), Samsung (20-25%)	SMIC (30%), Samsung (5-10%), GlobalFoundries (5-10%), Hua Hong, TSMC

Source: Company data, Credit Suisse estimates

Design service leveraged to China's CPU localisation

Design service companies have been able to support China's more aggressive stance in recent years in order to develop its own processors to capture more value in the tech chain and have better control of the IT ecosystem amid its ambition of "Made in China 2025" and the growing trade tension with the US. We believe that the PC/NB CPUs used by the government and SOEs are the first wave of chipsets that China aims to replace (5mn unit demand annually) and higher-end server CPUs should be the next (3 mn unit annual demand).

Figure 176: Comparison of the technology developments for the major China CPU fabless

China CPU fabless	Loongson	Phytium	Kunpeng	Sunway	Hygon	Zhaoxin
Shareholders	Institute of Computing Technology, Chinese Academy of Sciences	China Great Wall, CEC Group	Huawei	Wuxi Jiangnan Institute of Computing Technology	Sugon, AMD, Hygon	Shanghai Zhaoxin (VIA + Shanghai government)
Architecture	MIPS32	ARM v8	ARM v8	Sunway 64	x86	x86
PC	3A3000	FT2000/4	920s	SW410	7185	KX-6000
Tech spec	1.5GHz Quad core 64 bit	2.0GHz Quad core 64 bit	2.0GHz Quad / Octa 64 bit	1.6GHz Quad core 64 bit	2.0GHz 32 cores 64 bit	2.0GHz Quad core 64 bit
Manufacturing node	28nm	16nm	7nm	40nm	14nm	16nm
Server	3B3000	FT-2500/64	920	SW26010	7185	KH-30000
Spec	1.5GHz Quad core 64 bit	2.5GHz 64 cores 64 bit	2.5GHz 64 cores 64 bit	1.45GHz 260 cores 64 bit	2.0GHz 32 cores 64 bit	3.0GHz Octa cores 64 bit
Manufacturing node	28nm	16nm	7nm	28nm	14nm	16nm
IC design partner	NA	Alchip, EE2	HiSilicon	NA	AMD	VIA
Ecosystem support	Limited	Strong	Strong	Limited	Strong	Strong
Security	High	High	High	High	High	High
China technology control	High	Medium-High	Medium-High	High	Low	Low

Source: Company data, Credit Suisse estimates

We expect Phytium, a China ARM CPU fabless, to lead its local peers on a strong roadmap migrating to 16nm for PC/NBs and 7nm for servers, benefitting its design service partner

Alchip by supplying a US$720 mn TAM (far exceeding Alchip's US$144 mn sales in 2019). The company also has exposure in China's supercomputing system which should see content per system growing from US$30 mn for 16nm to US$50mn for 7nm.

Figure 177: Alchip's addressable market for China PC/NBs, server CPUs and supercomputing could reach US$780 mn

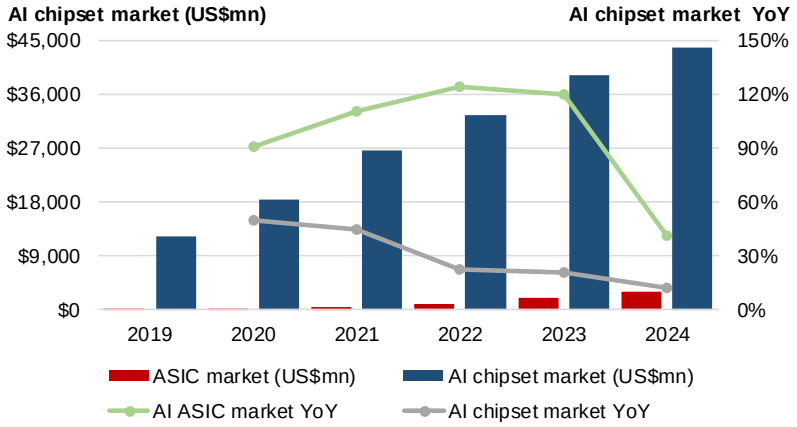
Alchip's turnkey business	2019	2020	2021	2022	LT addressable market
China PC CPU shipment (000 units)	400	1,800	2,100	3,000	6,000
China PC CPU ASP from Alchip (US$)	$45	$45	$45	$45	$45
China server CPU shipment (000 units)	0	10	50	150	3,000
China server CPU ASP from Alchip (US$)	$150	$150	$150	$150	$150
China CPU sales contribution	**$18**	**$83**	**$102**	**$158**	**$720**
Supercomputing sales contribution	**$0**	**$7**	**$43**	**$25**	**$60**
China CPU + supercomputing contribution (US$mn)	**$18**	**$90**	**$145**	**$183**	**$780**
Alchip's sales (US$mn)	**$144**	**$215**	**$289**	**$366**	
% of Alchip's sales	**12%**	**42%**	**50%**	**50%**	

Source: Credit Suisse estimates

Growing AI computing drives ASIC demand

Design service companies are also seeing new growth from AI chipset innovation accelerating to support demand for higher compute performance and the data analytics required for advanced semiconductor manufacturing technology.

Figure 178: AI ASIC is going to outgrow the AI semiconductor market



Source: Gartner, Credit Suisse estimates

Gartner expects global AI semiconductor revenue to grow from US$12.3 bn in 2019 to US$43.9 bn in 2024 at a CAGR of 29%.

Figure 179: Different types of chipset comparison for AI computing

	CPU	GPU	FPGA	ASIC
Processing peak power	Moderate	High	Very high	Highest
Power consumption	High	Very high	Very low	Low
Flexibility	Highest	Medium	Very high	Lowest
Training	Low	Moderate	Low-moderate	High
Inference	Low	Moderate	High	High
Cost per compute	High	High	Moderate	Low
Major applications	General computing	Cloud training Cloud inference	Cloud inference Edge inference	Cloud training Cloud inference Edge inference
Companies	Intel, AMD	Nvidia, AMD	Xilinx, Altera	Diversified

Source: Credit Suisse estimates

Although GPU and FPGA are the mainstream chipsets for AI computing, the demand for customised ASICs is rising, as they can provide more efficient computing for training and inference, with AI chipset projects mostly on 16/12nm and 7nm, and driving growth for Alchip/GUC in the coming years.

Figure 180: Most of the AI semiconductor projects are on the advanced nodes, with TSMC being the key foundry beneficiary

Start-ups	Key focus area	Country	Foundry	Most advanced node	Tech investors
AIMotive	Semiconductor chipset and software for automated driving	Hungary	GlobalFoundries	22nm FD-SOI	Cisco, Samsung
Blaize	Vision processing chips	US	TSMC	28nm HPC	Denso, Samsung
BrainChip	Neuromorphic SoC (Akida) that can be function as an SoC or integrated into ASIC	Australia	TSMC	28nm	Listed
Cambricon	Device and cloud processors for AI	China	TSMC	7nm	Alibaba, TCL
Cerebras	Systems Specialized chip for deep-learning applications	US	TSMC	16nm	NA
Deep Vision	Low-power silicon architecture for computer vision	US	TSMC	28nm HPC	NA
DeepcreatIC	Heterogeneous neuromorphic chips	China	SMIC	40nm	NA
Deephi	Compressed CNN networks and processors	China	TSMC	7nm	Xilinx
DinoPlus	High-performance and ultra-low latency AI chipsets for 5G/edge computing	US	NM	NM	NA
Enflame	Cloud-based deep learning chips for AI training platforms	China	GlobalFoundries	12nm LP	Tencent, SummiView
Esperanto	Massive array of RISC-V cores	US	TSMC	7nm	Western Digital
GrAI Matter Labs	AI chipsets designed for ultra-low latency and low power processing at the edge	France	TSMC	28nm	NA
Graphcore	Graph-oriented processors for deep learning	UK	TSMC	16nm	Dell
Groq	Google spinout working on deep learning chip	US	NM	14nm	NA
Habana Labs	Programmable deep learning accelerators for data center training and inference	Israel	TSMC	7nm	Intel
Hailo	Specialized deep learning microprocessor	Israel	NM	NM	NEC
Horizon Robotics	Chipsets and solutions for smart Home, automotive and public safety	China	TSMC	16nm	SK Hynix
IntelliGo	Hardware and software for image and speech processing	China	NM	NM	Mediatek
Intengine Tech	AI chips for embedded system for edge computing	China	NM	NM	NA
Kneron	NPU that accelerates neural network models making possible applications (e.g. face detection and gesture control) in embedded devices	US	TSMC	16nm	Alibaba, Himax, Qualcomm
Lightmatter	Programmable photonic to accelerate critical operations in deep neural networks	US	NM	NM	Alphabet
Lynxi	Brain-like computing chip for high performance computing	China	NM	28nm	NA
Mythic	Ultra-low power neural networking inference chips based on flash+analog+digital	US	Fujitsu	40nm	Lam Research, Micron, Softbank
Novumind	AI for IoT	US	TSMC	7nm	NA
Preferred Networks	Real time data analytics and chipset solutions with deep learning library	Japan	TSMC	12nm	Hitachi, Fanuc
Reduced Energy Microsystems	Chipset solutions for deep learning and machine vision with low power consumption	US	GlobalFoundries	22nm FD-SOI	NA
SambaNova	Reconfigurable Array platform for matrix arithmetic for AI applications	US	NM	NM	Google, Intel
SenseTime	Chipset solutions for computer vision	China	NM	NM	Softbank, Singtel, Qualcomm, Alibaba
SiMA.ai	Machine Learning SoC platform for high performance and low power consumption	US	NM	NM	Dell
Syntiant	Customized analog neural networks	US	NM	40nm ULP	Amazon, Microsoft, Intel
Tenstorrent	Deep learning processor for faster training and adaptability to future algorithms	Canada	GlobalFoundries	12nm	NA
Thinkforce	AI chips for edge computing	China	NM	NM	NA
Tsinghua Thinker	Low power AI chips for edge computing	China	TSMC	65nm LP	Tsinghua VC
Unisound	Chipsets for AI-based speech and text capability	China	TSMC	28nm	Qihoo
Vathys	Chipset design for deep learning supercomputers	US	NM	NM	NA
Wave Computing	ASIC solutions for deep learning computers	US	TSMC	7nm	Samsung
Xanadu	Quantum photonic processors	Canada	NM	NM	NA

Source: Company data, Credit Suisse estimates

Key stocks: Alchip and Global Unichip

Alchip a good pick addressing supercomputer, AI and China CPU projects

We recently initiated coverage on Alchip with an OUTPERFORM rating and NT$425 target price, implying 20% upside, based on 25x our 2021 EPS and factoring in our expectation for a 30% sales CAGR from 2019-22. We believe the upper half of the long-term valuation should be supported by the opportunity in China PC CPU replacement demand in addition to its AI exposure.

Separately, we also recently initiated coverage on Global Unichip with a NEUTRAL rating and NT$225 target price, reflecting 25x our 2021 EPS. We believe the company's share is fairly valued at the upper half of its range factoring in its opportunity in 5G and AI. Key risks include: (1) slower local CPU/AI penetration in China or US restrictions; (2) consolidation or failure of emerging AI start-ups and system company projects; (3) the US further expanding its ban on Chinese companies' access to IP/EDA tools; (4) customers growing and shifting to a foundry direct business model; and (5) intensifying competition from Verisilicon in China or build-up of more in-house teams.

CREDIT SUISSE

Global Semiconductors: Memory

Levered to increasing compute intensity

John Pitzer
212 538 4610

Keon Han
82 2 3707 3740

Dalya Hahn
212 538 7843

Sanguk Kim
82 2 3707 3795

Cyclical dynamics have a way of accentuating secular trends at peaks and obfuscating them at troughs. Given that it now appears we are approaching the latter, we believe it might be helpful to outline why we have been secular bulls on memory since 2015.

Any bullish thesis in memory needs a solid supply foundation. While managements enjoy discussing demand drivers—the next new thing, content growth, buzz words—it has been our experience that any bullish view on memory needs to be grounded in supply. Supply is more tangible and analysable, especially because demand is always the strongest when it is being significantly overstated—i.e. customers are building inventory.

Relative to supply—the secular thesis is fairly straightforward—as scaling has become more difficult, each successive node transition is leading to fewer incremental bits per wafer and a flattening cost curve, and this has continued to be the case for DRAM as cost-downs have declined from what was ~25% per year, to what we now see as ~8% per year.

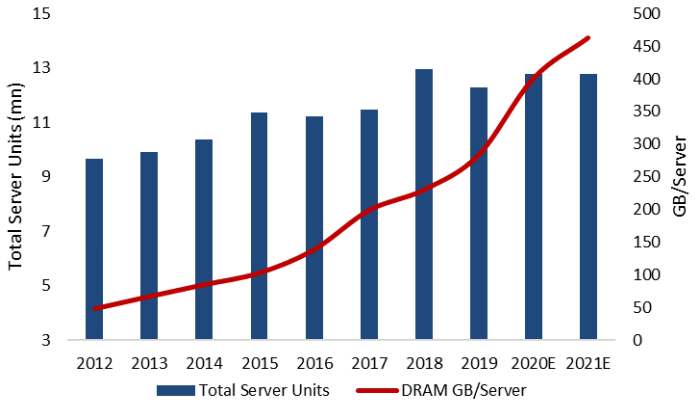
Bit/wafer growth is once again slowing. In NAND, flattening cost curves dominated the transition from 2D to 32L 3D as bits/wafer remained the same; however, there was a significant re-acceleration from 32L to 64L as incremental bits per wafer doubled—a significant driver of the oversupply in NAND in 2018-19. Importantly, now that the industry is transitioning to 9xL and for each successive generation, incremental bit growth/wafer is once again declining: 32L to 64L was a 100% increase, 64L to 9xL will be 50%, 9xL to 12xL will be 33% etc. This is an extremely important dynamic which we continue to believe the market has not fully grasped or appreciated.

Moore's Law also increases bit capacity. While a flattening cost curve might be viewed as negative for profitability/margins, we would remind investors that in semis, the same mechanism that lowers costs also increases capacity. Starting in the late 1990s through 2015 when Moore's Law was accelerating, 300 mm fabs were becoming more productive, cycle times were declining and cost curves were steepening—and any benefits from lower cost were more than lost to accelerating supply growth and corresponding negative impact to ASPs. We see flattening cost curves as indicative of more rational/constrained supply and fundamentally better through-cycle pricing.

Demand elasticity won't drive supply growth. The best concern/retort to our thesis is the impact that better pricing might have on long-term bit growth—i.e., price elasticity has been a key driver of memory content growth and when memory pricing increases OEMs are likely to respond by "de-speccing" as they have done before in the PC and handset markets. While we have sympathy for this concern (especially for NAND which we view as more elastic), we would make several counter-points:

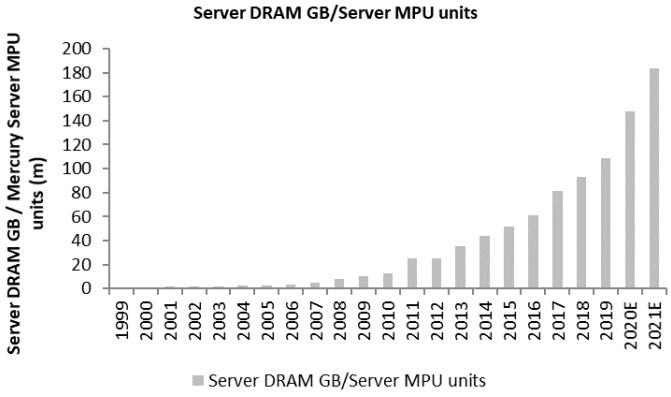
DRAM is more inelastic than elastic especially in the cloud. The primary function of DRAM is to keep a processor fed when processors are mostly contained in PCs, tablets and handsets where applications are "good enough" and utilisation is low, i.e., processors are not eating often. DRAM content has a low ceiling; however, when you move processing power to the cloud, hyperscalers' primary economic driver is utilisation. The more highly they can utilise the data centre, the more profitable they will be. Thus, with high utilisation meaning processors want to eat all the time, increasing DRAM becomes a point of leverage at any price.

Figure 181: DRAM server content driving growth



Source: Company data, Gartner, Credit Suisse estimates

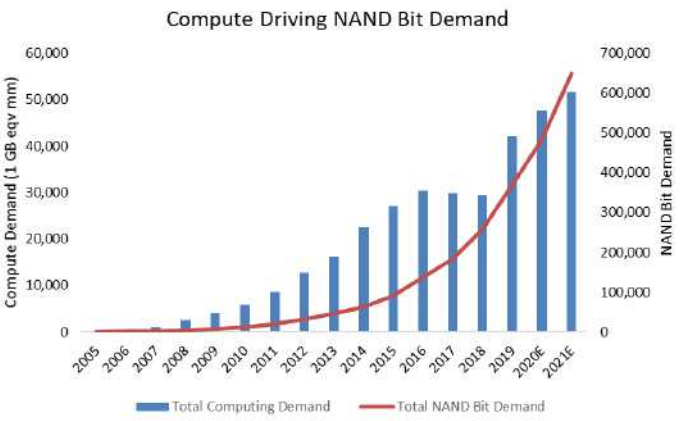
Figure 182: DRAM content/MPU units



Source: Company data, Gartner, Credit Suisse estimates

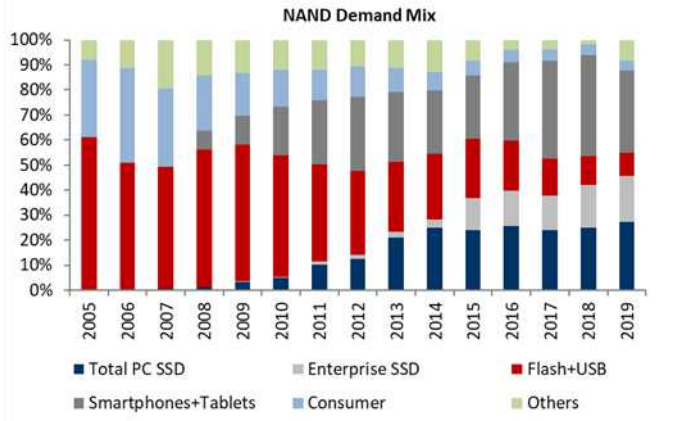
We have yet to see the impact of AI/ML workloads on DRAM demand. These workloads are extremely memory/DRAM intensive. There is no cognition without memory. The DGX2, NVIDIA's ML server, has a maximum configuration of 1.5 TB of DRAM versus the average server of just 50 MB. While the DGX2 has ~1/2 the processing power of the human brain (note that the DGX2 needs 3,200 Watts, while the brain needs 32 Watt—i.e., biology is still multiple orders of magnitude more efficient), the human brain still has 100-300x the memory capacity of the DGX2. Most if not all of the private start-ups in semis are focused on solving the memory wall.

Figure 183: Computing demand vs total NAND bit demand



Source: Company data, Gartner, Credit Suisse estimates

Figure 184: Changing NAND demand mix



Source: Company data, Gartner, Credit Suisse estimates

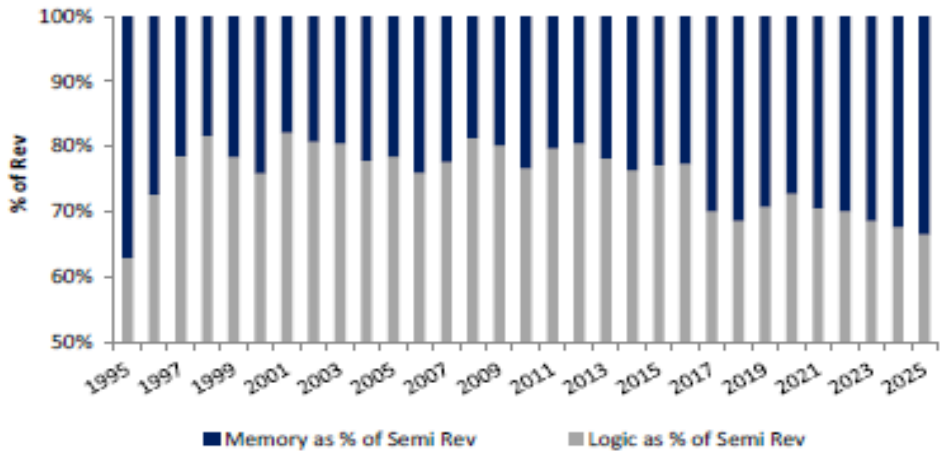
NAND is clearly driven by elasticity and a longer-term flattening of the cost curve is likely to put downward pressure on long-term NAND demand assumptions of 30-40%. However, we see a significant upgrade cycle coming in handsets in 2H20/2021—as 5G phones become more readily available. Data would suggest that consumers are delaying their upgrades and that the installed base of handsets is 12-18 months older than it was just a few years ago. Even without a killer app, we see 5G as a catalyst for consumers to upgrade.

Memory becoming a more valuable resource in data centres

DRAM and NAND designs are no longer simple. The origin of DRAM was to feed PCs that were simpler in spec and design, similar to planar NAND for storage in mobile devices prior to the advent of 3D NAND. As time progresses and the memory end market diverges to countless devices (IoT), spec is no longer defined. Every memory customer has their own spec; thus, memory continues to become more customised and is becoming a more valuable resource. This

is also true in server DRAMs. Hyperscalers no longer use OEM-built servers; instead, they design their own servers for scale, profit optimisation and operating cost efficiency. We believe that this trend will accelerate as data centres built for public cloud services become more dominated by hyperscalers driving the steady demand increase for overall memory. In a short span of time, the server DRAM portion of the market has climbed from 18% to nearly 35%.

Figure 185: Memory rising as a % of total semiconductor industry value

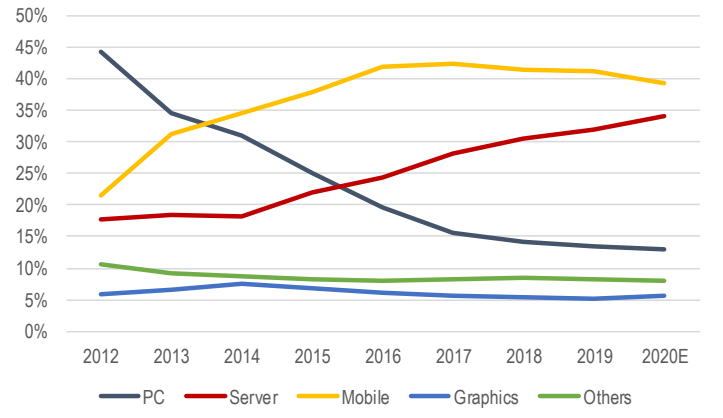


Source: Dram eXchange, Credit Suisse estimates

Server close to rivalling mobile as the key driver of the DRAM market

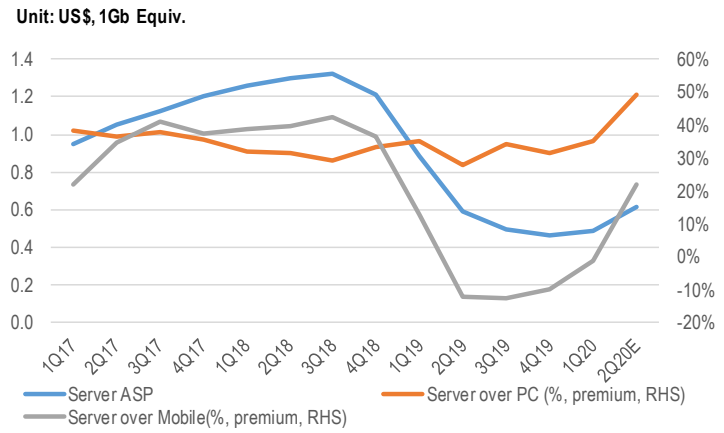
Server to surpass mobile DRAM demand in a few years. Since 2016, the demand *growth rate* of server DRAM began to surpass mobile DRAM. We project *total* demand from servers to surpass the aggregate demand of the mobile segment by 2022-23. We believe that this is achievable given that: (1) global server shipments are expected to deliver a 7% CAGR to 2023 with the content-per-box growth rate at 15-20% YoY; (2) hyperscalers continue to represent a larger portion of global data-centre build-outs accounting for 87% of installed based public cloud servers; (3) newly installed data-centre CAGRs remain at 11%, having faster growth rates than the overall server average, representing consumption growth in memory; and (4) cloud data centres now constitute a majority of new data-centre storage capacity. The memory density increase per server unit should show similar trends experienced by the PC and mobile phone industry in the early years with density per box growing faster in earlier phases. Data workload continues to shift into the cloud while the number of connected devices is growing exponentially. Adding new services and software require more powerful CPUs that require more memory intensity.

Figure 186: Server has nearly caught up to mobile DRAM demand



Source: Dram eXchange

Figure 187: Server DRAM now commands a premium over PC/mobile



Source: DRAM eXchange

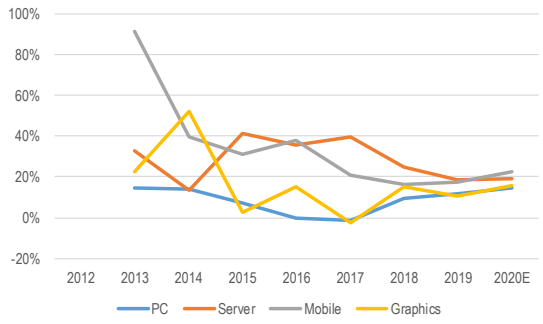
Market opportunity for the group

CPU cores and memory channels growing. Just as desktop PCs use their own CPU design (Intel i7, i9, etc.), servers use server-dedicated CPU series such as Intel Xeon (X86). Server processors need to be fast, and perform multiple and simultaneous tasks. The main difference is that a server CPU is typically mounted on a motherboard as two or more units in order to handle a high workload. Depending on the spec and purpose of the server (AI, web, database, storage, etc.), the memory requirement varies, but directionally would grow as more processors are added. The CPU-to-memory ratio is balanced for optimal server performance and specific tasks. Similarly, the server CPU's core count (a maximum 48 cores as in the Intel Cooper Lake Xeon) and rising memory channel support (eight channels) should continue to correlate to higher DRAM intensity, as CPU bandwidth rises.

Error correction code (ECC) requirement in server DRAM becomes more important. The primary difference between a PC DRAM and server DRAM is the requirement of ECC. Server processors, such as the Intel Xeon, would use ECC RAM. ECC detects and corrects any data that was incorrectly processed by a DRAM module before the memory error occurs. As data-centre servers are up and running continuously, any memory error could bring down the entire server and could cause data corruption. Severs cannot go down for any reason; therefore, ECC capability in server DRAM is an extra layer of protection. ECC is an algorithm placed in the memory controller and represents one check bit for each byte of data. As it takes up space, in order to store the ECC code in the memory, the bandwidth requirement increases. Server memory modules (eight chips) could have an added chip for storing ECC (the ninth chip). DDR5 for servers (2021) will likely incorporate on-die ECC. DRAM makers addressing these complexities will likely benefit with larger market shares. Already having introduced LP DDR5, we believe that Samsung should continue to lead the Server DDR5 advancement.

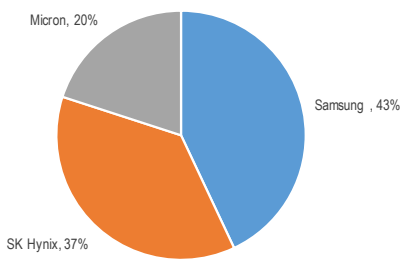
Servers are eventually consumables and need replacement. Similar to PCs and smartphones, we believe that data-centres (servers) are consumables that require replacement in a relatively shorter duration. While server life cycle varies, the replacement cycle could be as short as three years given the wear and tear from continuously running. Additionally, each generation of new CPU could compel replacement if the server is different enough to make a notable impact on performance or operating costs. Offering the latest CPU also means a competitive edge among cloud service providers. A shift in server CPU generation can compel an entire instance type of servers in a data-centre: AMZN Web Services (AWS), for example, has 30 instance types making up millions of installed base servers across the world. Also, a customer's data centre needs to vary depending on the specific service required and geographical location, which necessitates constant shifts and additions of server types. With 80% of global Server DRAM market share, we believe both Samsung and SK Hynix are in a strong position to benefit from data centre industry growth.

Figure 188: Server DRAM content growth stable at ~20% per annum



Source: DRAM eXchange, Credit Suisse

Figure 189: Korea dominates Server DRAM with an 80% market share—2020E



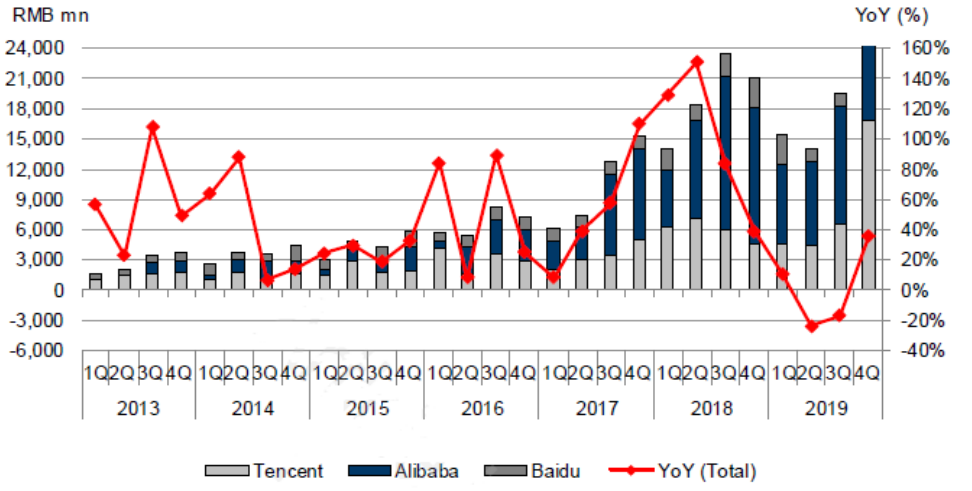
Source: DRAM eXchange, Credit Suisse

China demand potential and risk. China's public cloud market experienced an exponential 64% CAGR over the past five years, reaching US$7.5 bn (or Rmb50 bn) in 2018, according to IDC. Despite the rapid growth, China's public cloud market is still nascent, evidenced by cloud IT spending merely accounting for 3% of China's GDP in 2018, half that of the US. Meanwhile, public cloud penetration (as a ratio to total IT spending excluding devices) was low, at a mere 10%, despite a big leap from 2% in 2014. In comparison, the US public cloud market is much bigger, at US$111 bn in 2018, or 15x larger, constituting 61% of the global cloud market. China's demand potential is therefore great.

China a long-term risk for the memory sector, although the market offers a good potential source of growth

Despite faster growth rates in cloud infrastructure investment, China generally lacks domestic suppliers of upstream semiconductors such as CPUs and memory. In 2014, China's government issued a National IC Development Guideline to advance key semiconductor development and production domestically. While memory semiconductor development has not been explicitly stated, capital allocation toward the memory industry seems to be the natural outcome given the attractive size of the addressable end-market and break-away from 100% reliance on imports as a sourcing diversification strategy. It has already selected its DRAM champion in CXMT and NAND in YMTC. China failing in DRAM/NAND development would be industry neutral, while success could bring about a global oversupply risk in the future. Currently, the consensus expectation is for China to succeed in NAND on a limited basis, while DRAM development would likely prove more challenging.

Figure 190: China major Internet players' capex



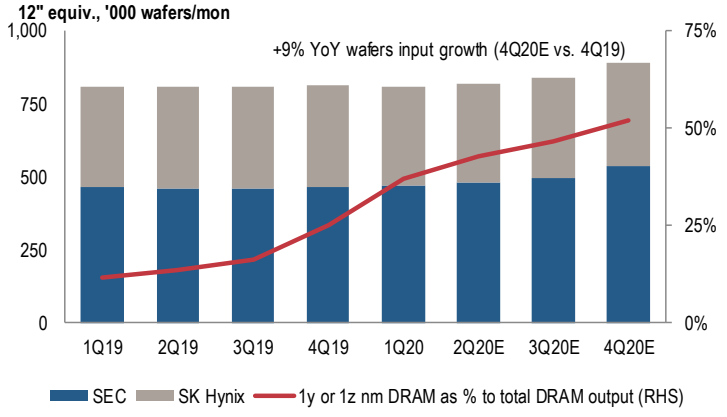
Source: Company data, Credit Suisse

Supply chain implications

Memory supply kept under control as older lines are converted to other applications like CMOS image sensors

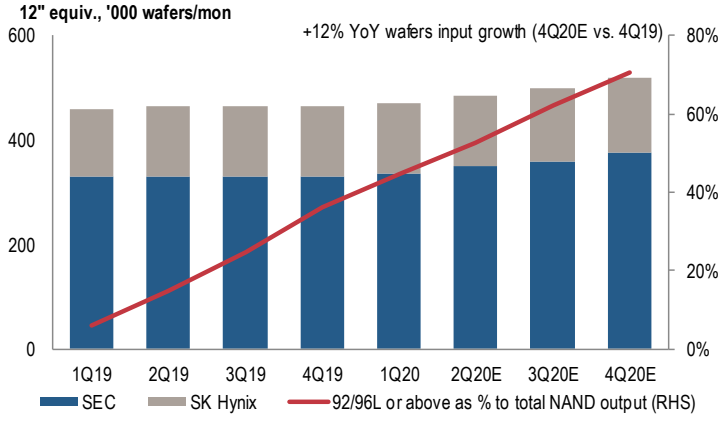
Investment for memory technology-advancement will continue. Rising data-centre builds are expected to continue to expand the total memory (DRAM/NAND) addressable market. In addition, requirements to support high data-processing speeds with a need for better cost-structure/higher density and memory makers' investment on technology advancement would continue either through node migration at DRAM or adding more layers on 3D NAND. Now with better inventory conditions at KR chipmakers (SEC/SK Hynix), KR memory makers' efforts on technology investment will likely materialise by leveraging their newly built fabs in and out of Korea, such as SEC (Xian II fab/Pyeongtaek II fab) or SK Hynix (M15, M16 and Wuxi II fab). Nonetheless, total memory supply growth will likely be controlled thanks to the optimisation of production lines (i.e., conversion of obsolete DRAM lines into CIS).

Figure 191: KR chipmakers—DRAM wafer input capacity vs. technology migration



Source: Company data, Credit Suisse estimates

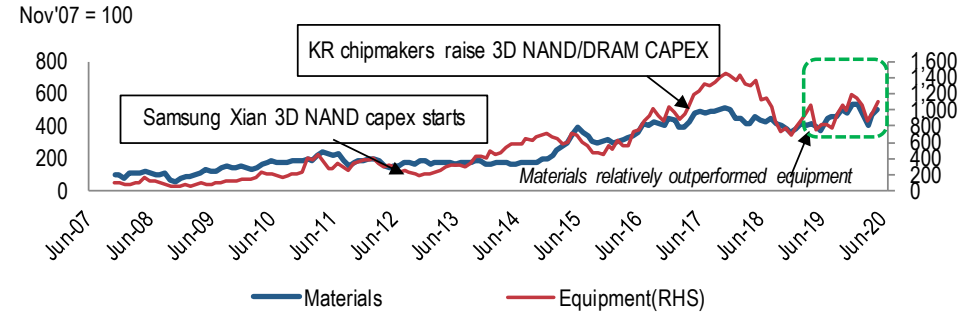
Figure 192: KR chipmakers—3D NAND wafer input capacity vs. technology migration



Source: Company data, Credit Suisse estimates

KR memory value chain well placed to benefit even fuelled by localisation effort. Against this backdrop, the KR memory supply chain (equipment/materials) will continue to benefit particularly when the industry's inventory situation becomes healthier and overall memory makers' fab UTRs recover. Due to demand uncertainties over the COVID-19 pandemic, overall memory capex will likely remain disciplined; however, at least for supplementary capex to make up for wafer capacity loss amid tech-migration this is likely to happen heading into FY21E. Particularly, SK Hynix's supply chain may be able to see the bottom of its order cycle into 2H20E given the client's necessity for technology innovation, improving memory profitability (NAND) and preparing new cleanroom spaces (M15/M16 and Wuxi II fab). Furthermore, ongoing supply chain localisation efforts in Korea, triggered by JP's restrictions on core IT chemicals export (HF gas/EUV PR/Fluorinated polyimide) should continue to support market share gains for KR equipment/materials, with more intense collaborative R&D. Among our coverage universe, we like SK Materials (036490.KQ; OUTPERFORM; TP W225,000) given its more balanced top-line growth covering both IT and non-IT chemical market, its benefits from localisation efforts particularly at SK Hynix and accelerating EPS growth into FY21E (+41% YoY) with a better memory inventory cycle.

Figure 193: Memory value chain—historical share price performance between equipment/materials



Source: Company data, Credit Suisse

Stock outlook

Samsung, Hynix and Micron poised to benefit from a healthy demand driver from the server market

Samsung Electronics (005930 KS): Samsung's highly diversified and vertically integrated business model is well positioned to benefit from global data-centre growth. Samsung dominates in the memory semiconductor production with ~50% market share and is the leading Server DRAM maker with a 43% market share. It remains the gold standard in DRAM with the

start of 1z nm process implementing EUV technology, development and usage of LP DDR5 (server DDR5 in 2021) and leading in HBM1 and HBM2 (High Bandwidth Memory) used with GPUs required in video intensity and AI computing. In NAND, it was the world's first to develop and produce 3D NAND and SSD for enterprise servers, which it now dominates. Samsung remains the undisputed memory supplier of choice among the hyperscalers.

SK Hynix (000660 KS): With a 37% global Server DRAM market share, SK Hynix has been a consistently reliable DRAM producer throughout its history. While generally slightly behind in new DRAM design and technology development compared to Samsung, it retains high customer satisfaction for the high performance and reliability of its Server DRAM products. Its Wuxi, China, DRAM fab base keeps manufacturing and distribution closest to its largest customer base in China. Hynix's NAND programme is still a bit of a work in progress, being late to 3D NAND transition and recent over-investment in 36L/72L NAND capacity. However, the severe losses are beginning to be mitigated as more 92L production expands. SK Hynix is a pure memory semiconductor company with 75% of revenue generated from more profitable DRAM products.

Micron (MU US): DRAM continues to make-up most of MU's revenue, accounting for ~68% of CY19 revenue and ~20% of total global production share. DRAM also drives a higher proportion of the company's profit with average GM of ~45% vs NAND ~21%. MU achieved ramped 1y production in 1Q FY19 and meaningful production in 3Q FY19—we expect MU to achieve bit crossover in 1Q/2Q FY20 consistent with the timeline for 1x. As of MayQ, 1y/1z nodes together made up >50% of bit production and MU continues to progress on 1-alpha node (expected FY21) and is managing the construction schedule of its Taiwan cleanroom expansion, remaining on target for CY21 first output. It is also the only DRAM vendor with no new fab plans and, unlike its major competitors, has no plans for the adoption of EUV technology as yields on existing technology remain high.

NAND makes up ~27% of MU revenue and ~16% of global production share. MU was able to limit its declines in 2019 compared to the industry due to higher bit growth and strong performance in mobile memory and SSDs. MU has progressed well on its cost-effective 96L floating-gate technology (we expect the company to achieve bit crossover in 4Q FY19/1Q FY20) and has also initiated shipments of QLC 3D NAND flash. High-value QLC bits now represent >10% of MU's overall NAND production, contributing to NAND cost improvements. Overall, NAND high-value solutions now make up >75% of total NAND bits, on target to increase to 80% by FY21

Japan technology sector

Electronic components

Akinori Kanemoto
81 3 4550 7693

Hideyuki Maekawa
81 3 4550 7690

The likely beneficiaries of expansion in the market for data centre-related business are Ibiden, which supplies flip-chip packages (FC-PKG) for server CPUs and GPUs and module substrates for server CPUs, and Shinko Electric, which manufactures FC-PKG and heat spreaders for server CPUs and electrostatic chucks for SPE. We forecast that a switchover to next-generation products by customers from 2H CY20 will accelerate the shift to high multilayer and large diameter server-use FC-PKG, that multi-chip module (MCM) server CPU chipsets will shift to 2.5D packages, and that rising demand for integrated CPU-GPU-HBM (high bandwidth memory) will drive an increase in the added value of substrates. However, we think these developments have already been priced in to current share prices. For HDD-related component makers Nidec (HDD-SPM motors), Minebea (supplier of fan motor ball bearings, as well as HDD-SPM motors and pivots) and TDK (HDD heads, suspension), we expect growth in sales of nearline HDDs for data centres to partially offset contraction in sales of PC HDDs, and look for higher sales of high-value-added server-use MLCCs (7XR, X6C spec) in the passive components business.

Semiconductor

At Renesas Electronics, the 2019 acquisition of IDT supplies semiconductors for data centre and network applications, specifically products such as fully buffered DIMM (dual in-line memory module) chipsets, timing clocks and PMIC (power management ICs) for data centres. The company commands a 50% share of the DIMM chipset market, and we expect demand for LRDIMM (load reduced DIMM) to increase from the Intel Cooper Lake server CPU generation on. Data centre application sales currently generate only around 5% of consolidated sales, but we expect the weighting to grow over the long term.

Networks

We expect long-term growth in cloud use to generate higher demand for cloud interface devices 5G smartphones and 5G IoT, which are using increasing volumes of data. We anticipate expansion of data centre network infrastructure and see this as an important business opportunity for Anritsu: we expect growth in demand for the company's measuring instruments for use in 5G smartphone and IoT applications, and for its optical devices for network infrastructure application.

Stock outlook

For Ibiden (4062, NEUTRAL, TP ¥3,280) and Shinko (6967, NEUTRAL, TP ¥1,660), we think expansion of server CPU FC-PKG have already been priced in to current share prices and we have a Neutral rating on Ibiden and Shinko.

We recommend Renesas Electronics (6723, OUTPERFORM, TP ¥1,290) with the recovery of automotive production and data centre demand, which will also support the growth. And we also recommend Anritsu (6754, OUTPERFORM, TP ¥2,880) for 5G smartphone growth in 2H 2020 and 2021.

China data centre operators

Growing with the cloud

Colin McCallum
852 2101 6514

Data centres are essentially large buildings with uninterrupted power supply, air-conditioning and connectivity to the backhaul of the telecoms carriers, and these buildings host IT servers in a secure and stable environment. Data centre operators receive monthly rent from the IT tenants which are their customers, based on the floor area occupied by the tenants and the power they consume.

Data centres can therefore be thought of as necessary infrastructure for telecoms and internet services. Crucially, the more servers which are required to support internet content, the higher the demand for data centres. As such, there is a very clear link between data centre demand and data volumes, which are rising rapidly. Furthermore, since cloud computing involves data, software and processing power being held in a location other than an individual's work station, growth in the use of cloud computing has clear implications; an increase in cloud computing would, by definition, increase demand for internet storage facilities such as data centres.

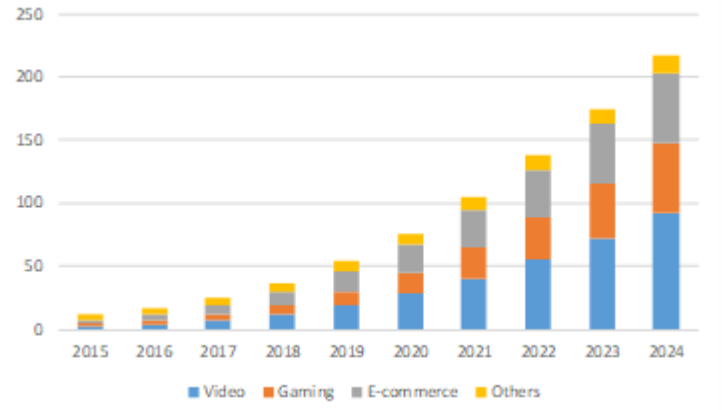
In addition to the traditional 'universal' benefits for users of cloud computing, such as the ability to share, update and compute quickly and efficiently, as well as lower IT spending and maintenance costs, we observe that China's government has been very supportive of cloud development, which effectively leads to centralisation of data collation and storage, and therefore improved control. Thus, state-owned enterprises (SOEs) have been encouraged to shift their programs, software, platforms and data onto the cloud. Other companies and individuals in China are also rapidly adopting public, private and hybrid cloud services.

Cloud revenue as a proportion of IT expenditure in China is still only 6.0%...

This shift has encouraged all of China's internet 'hyperscalers', together with overseas software companies such as Microsoft, to launch public, private and hybrid cloud services in China. Growth has been rapid. Frost & Sullivan has highlighted that spending on cloud services in China—the second-largest market in the world after the US—experienced a CAGR of 37.7% from Rmb45.0 bn in 2015 to Rmb161.8 bn in 2019. During that period, cloud services as a percentage of total IT spending in China increased from 2.0% (in 2015) to 6.0% (in 2019).

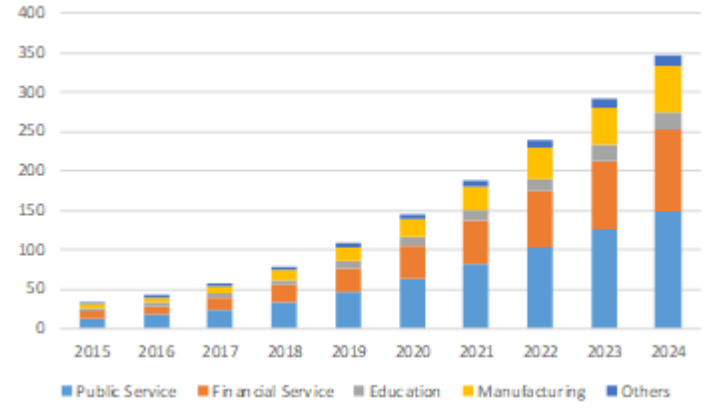
Looking forward, the potential for growth is material; Frost & Sullivan estimates that spending on cloud services as a percentage of total IT spending in the US increased from 9.0% in 2015 to 15.8% in 2019 (and is expected to reach 33.7% in 2024). In China, Frost & Sullivan expects cloud services as a percentage of total IT spending to reach 15.8% in 2024, driving a 28.3% CAGR in cloud service revenue across FY19-24. Thus, cloud service revenue is expected to reach Rmb563.3 bn in 2024.

Figure 194: Cloud revenue driven by internet verticals (Rmb mn)



Source: Frost and Sullivan

Figure 195: Cloud revenue driven by enterprise (Rmb mn)



Source: Frost and Sullivan

Frost & Sullivan sees two key growth drivers for cloud service revenues. First, there is expected to be high growth in demand from internet verticals, including video (a 37.9% CAGR), gaming (26.8% CAGR), e-commerce (28.9% CAGR) and others (11.5% CAGR). This is expected to drive a 32.2% CAGR in revenue from Rmb53.8 bn in 2019 to Rmb217.5 bn in 2024.

…and Frost & Sullivan projects a 32.2% CAGR in cloud demand from internet verticals…

Second, Frost & Sullivan projects increasing penetration of cloud into traditional enterprises and state organisations, as they shift IT infrastructure onto the cloud to enjoy cost savings, increased flexibility and increased data security. This engine is projected to drive revenue at a CAGR of 26.2% from 2019 to 2024, from Rmb108.0 bn in 2019 to Rmb345.9 bn in 2024. The two highest growth segments are expected to be financial services at a 28.1% CAGR and manufacturing at a 28.4% CAGR.

…and a 26.2% CAGR from enterprises

While barriers to entry are relatively low, when compared with, say, the telecoms industry, barriers to entry are quite some way from 'zero'. Access to land in the correct places (together with power quotas), access to fibre, and access to funding are all key ingredients which must be executed well. Once all of these 'factors of production' have been secured, the project management must be smooth and the IDC provider must ensure consistent high quality services to its customers. The table below shows estimated returns on capital for data centres in China – the fastest growing segment of construction within Asia.

Done well, data centre construction is a value-accretive business

Data-centre construction is a relatively capital-intensive business, involving the deployment of circa US$138 mn to US$181 mn per large, high-powered data centre. Clearly, the data centre must be constructed first—a process that takes 12-18 months, before revenue is generated, and so access to finance is crucial.

Figure 196: ROIC analysis—'retail' versus 'wholesale'

	Retail		Wholesale	
	Rmb mn	US$ mn	Rmb mn	US$ mn
Annual revenue	444	63	576	82
EBITDA margin	50.0%	50.0%	48.0%	48.0%
EBITDA	222	32	277	40
Depreciation (years)	14		13	
Depreciation	(70)	(10)	(98)	(14)
EBIT	152	22	178	25
Tax rate (%)	25.0%		25.0%	
Tax	(38)	(5)	(45)	(6)
NOPLAT	114	16	134	19
Land and shell capex	365	52	365	52
Capex construction	240	34	360	51
Capex facilities	360	51	540	77
Total capex	965	138	1,265	181
ROIC	11.8%		10.6%	
Payback revenue (years)	2.2		2.2	
Payback EBITDA (years)	4.3		4.6	

Source: Company data, Credit Suisse estimates

However, our analysis shows that if the operator successfully achieves relatively fully utilisation (specifically, 85% utilisation under the retail model of renting space to SMEs and 98% under the wholesale model of renting to 'hyperscalers') then the returns on capital are above cost of capital, at 11.8% and 10.6% respectively based on current economics.

Since we conclude that the business is value-accretive, the faster the operator raises finance and constructs capacity, the more value created. We currently have OUTPERFORM ratings on both GDS and VNET. In contrast, we rate Dr. Peng UNDERPERFORM; it has insufficient capital to grow its data centre business, while its core fixed broadband access business remains under competitive pressure.

China cloud operators

Alibaba: The dominant cloud service provider

Tina Long
852 2101 7197

Kenneth Fong
852 2101 6395

Kyna Wong
852 2101 6950

Stephen Yin
852 2101 6980

Alibaba's cloud business AliCloud was established in 2009 to meet the surging internal need of computing power and started serving external clients since 2011. Being the earliest mover in the cloud market in China a decade ago, AliCloud has spearheaded into the public cloud segment, and currently offers both IaaS (Infrastructure as a Service) and PaaS (Platform as a Service) to thousands of enterprises and government entities. As of 1Q19, it enjoyed a market share of 43% in China's public cloud market, the largest one with shares equating to the aggregation of No 2 to 7 players, based on data compiled by IDC. On a global basis, Alibaba had 6% of the global cloud market as of IDC's last update in July 2019. In FY20, AliCloud has served 38% of Fortune 500 companies and it aims to become the world's leading digital intelligence backbone in the coming three years with US$28 bn committed capex investment.

Alibaba had 6% of the global cloud market, but opportunity to expand with China's fast growing public cloud market with +64% CAGR the past five years

China's public cloud market experienced an exponential 64% CAGR over the past five years, reaching US$7.5 bn (or Rmb50 bn) in 2018, according to IDC. Despite the rapid growth, China's public cloud market is still nascent, evidenced by cloud IT spending merely accounted for 3% of China GDP in 2018, half of that of the US. Meanwhile, the public cloud penetration (as a ratio to total IT spending excluding device) was low, at a mere 10%, despite a big leap from 2% in 2014. In comparison, the US public cloud market is much bigger, at US$111 bn in 2018, or 15x larger, constituting 61% of the global cloud market.

In our view, AliCloud is well positioned to benefit from the industry tailwind, with key advantages:

1) **Technological robustness well tested:** AliCloud spent years to develop the in-house Apsara big data platform, which could support smooth order processing during peak seasons. During double 2019 double 11, AliCloud processed a peak order rate of 554,000 orders per second—1,360 times more than the inaugural double 11 in 2009. And smart logistics engine powered 1.2 bn packages.

2) **Well-established user base:** AliCloud benefits from the 2B relationship established through Taobao, Tmall's marketplace business and acquisition of China Civilink (万网, a leading internet infrastructure service provider).

    a. Alibaba acquired China Civilink for Rmb540 mn in 2009 and integrated the business into AliCloud in 2013. The 200,000 business clients on the Civilink constituted the early user base of AliCloud.

    b. Additionally, Tmall and AliCloud launched CloudTmall (聚石塔) system together with China Civilink in July 2012, providing computing, database and other cloud services to Tmall and Taobao merchants. Through CloudTmall, AliCloud gets access to millions of merchants on Tmall and Taobao.

    c. In FY19, AliCloud had more than 1.4 mn paying customers, covering ~50% of Top 500 Chinese brands and more than half of A-share listed companies in China. Top clients are from industries such as internet, video, live streaming, e-commerce and financial services, which are tech-savvy and relatively easy to penetrate. AliCloud also added industry coverage across media, government, manufacturing, education and telecommunications in 2016-17. Medical health, retail, tourism, transportation & logistics, real estate & construction, energy, agriculture, IoT and AI were added in 2018-19.

3) **Going global:** The overseas market would be another growth driver. AliCloud has achieved decent market share overseas—according to Gartner, AliCloud leads the APAC market with 19.6% market share, and ranks third globally with 7.7% market share, following AWS (48%) and Azure (15.5%). The overseas market is deemed to be of strategic importance to AliCloud. It is the only cloud service provider that established data centres in India and Indonesia.

We are confident that AliCloud will develop into a cornerstone business for Alibaba, as AWS does for Amazon. We see four main drivers for Alibaba's cloud segment in the coming few years:

1) **Scale:** Scale is critical in public cloud as it enables reinvestment in differentiating services and drives down the cost of adoption. Meanwhile, similar to AWS, AliCloud dominates the public cloud market in China, with 40%+ market share, while the second-ranked player only has teens level of shares. We note cloud service providers are required heavy upfront capital investment for years in order to build up the capacity, AliCloud's leadership is highly likely to sustain in our view.

2) **Mix shift to PaaS** and more value-add service: Starting off with offering the more commoditised IaaS, AliCloud has been learning and evolving to offer more value-add PaaS as well as teaming up with a strong line-up of Independent software vendors (ISVs) to provide comprehensive end-to-end solutions to business customers. Per our checks, PaaS in general attracts around 10% higher margin vs IaaS, and a segment-mix shift would steadily make AliCloud more profitable. In Alibaba's case, we estimate PaaS-related revenue accounts for a bit over 10% of segment revenue at the moment.

3) **Higher customer retention and ARPU:** The rounds of price cuts in the past few years by AliCloud and its peers, in our view, are to encourage cloud adoption by new customers. Once the customers come, there are plenty of opportunities for AliCloud to up-sale a higher stack of products, and raise retentions and ARPU. We note that the customers onboarded in 2018 paid twice the ARPU of that of the customers onboarded in 2016. Meanwhile, the introduction of more value-add services will also improve retention.

4) **Operating leverage:** AliCloud's adjusted EBITA margin has narrowed from -41.5% loss to a mere -3.5% between FY16 and FY20 on the back of a 90% revenue CAGR. We believe operating leverage will continue to improve margins riding on 61% revenue CAGR from FY20 to FY22. We project the EBITA margin to turn around and reach 2% in FY22 after breaking even in FY21.

Kingsoft Cloud: The largest independent cloud service provider in China

Kingsoft Cloud is the largest independent cloud service provider in China

Kingsoft Cloud (KC) was established in 2012, and is the largest independent cloud service provider in China, focusing on IaaS and PaaS, with its cloud solutions including both public and enterprise clouds. KC focuses on premium customers across its strategic verticals and had 243 premium customers by end of 2019. As of 2019, KC was ranked among the top 6 public service providers with ~5.4% market share in IaaS + PaaS in China, according to Frost & Sullivan. KC is also among the top three internet cloud service providers in China in terms of revenue, and top ten public cloud service providers globally in terms of revenue from IaaS public cloud services in 2018.

China's cloud market is ~5 years behind the US. On the back of continued strong demand on internet verticals, multi-cloud deployment and traditional industries picking up steam in cloud deployment, China's cloud service penetration (cloud spending/IT spending) is expected to improve from 6% in 2019 to 15.8% in 2024. Other medium-term structural industry drivers include: (1) 5G, AI and IoT technologies applications, (2) overseas expansion on "Belt and Road" countries, and (3) policy support from Chinese government. This process is further accelerated by COVID-19 that boosted online consumption scenarios.

In our view, KC is well positioned to benefit from the industry tailwind, supported by its leadership and focuses:

- Largest independent cloud service provider in China: As top cloud service providers are normally internet conglomerates engaged in a wide range of business segments, potential conflicts of interest arise. KC offers full commitment to cloud services as its key and sole business driver and its neutrality offers it the competitive advantage vs. its peers. Besides, KC

will enjoy the "spill-over" benefit for customers from leading cloud providers like BABA and Tencent looking for the second or third cloud provider, also known as multi-cloud strategy.

- Strategically selected verticals with high growth opportunities: KC focuses on a few strategically selected high growth areas such as online games, online video, and Finance and banking vertical, with 37%/38%/28% 2019-24E CAGR, respectively.
- Superior enterprise service capabilities with monetisation efficiency: KC has covered sector-leading companies and we expect it will continue to win blue-chip customers across industries. KC's net dollar retention rate of Public Cloud Service Premium Customers stayed at a high level of 161%/155% in 2018/2019.
- Strong technology capacities: With a strong R&D team (1,150 staff by end of 2019) and capabilities to continuously upgrade its cloud solution, KC's tech leadership includes first full-stack virtual cloud products, commercialised AI cloud PaaS platform, industry-leading edge computing products, and container technology in its CDN business, etc.

Xiaomi and Kingsoft Group are two strategic partners to support KC's long-term growth and successful execution of its strategies. In the medium term, we expect KC's market share in public cloud (IaaS + PaaS)/traditional enterprises to reach 7.9%/5.7% respectively by 2024, driven by its growth strategies, improving revenue mix and operating leverage:

- Scale and growth strategies: KC plans to enter new emerging verticals such as IoT, AT and healthcare, and expects to adopt premium-customer strategy to cover and anchor industry leaders in new verticals. Despite KC still lagging the top Chinese players such as Ali Cloud/Tencent Cloud in terms of international footprints, we see its plan to invest ~50% of IPO proceeds (near Rmb2 bn) in upgrading and expanding its infrastructure should further increase its scale and international footprint.
- Mix shift to enterprise cloud: With faster growth in higher margin enterprise cloud (110% CAGR) vs. public cloud's 49% CAGR, we expect the revenue share of enterprise cloud to increase from 12%/13% in 2019/1Q20 to 43% in 2024, as a result CDN's revenue share should decrease from 54% in 2019 to 30% in 2024.
- Expanding premium customer base and ARPU: On customers' business diversification/expansion, we forecast ARPU for KC premium customers to reach Rmb33.2mn by 2024 (16% 2019-24 CAGR), with total number of premium customers to grow by 41% CAGR and reach 1,339 by 2024. Revenue from premium customers is expected to consistently account for 96%+ of total revenue.
- Revenue/margins growth: We forecast revenue to grow by 64% CAGR (2019-24E) and reach Rmb46.3 bn by 2024E. KC's non-GAAP gross margin has shown a consistent improvement from -9% in 2017 to +5% in 1Q20 on mix and operating leverage. We expect this trend to continue to reach a normalised 20% in 2023. With decreasing opex percentage of revenue, we forecast non-GAAP OPM to improve from -18% in 1Q20 to +11% in 2024E, with adjusted EBITDA and net profit to turn positive in 4Q20 and 2Q22, respectively.
- Improving cash flow: After KC's initial investment over the past few years, we expect the asset utilisation will continue to improve as scale builds up. As such, we expect the growth of revenue would be faster than capex, leading to an improvement in cash flow. We expect operating cash flow and FCF to turn positive in 2021 and 2023, respectively.

Stock Section

CREDIT SUISSE

Accton

Beneficiary on ODM-direct proliferation in switch but limited upside in the near term

IT Hardware

2345.TW

FOCUS LIST STOCK

Target price (12M, NT$)
240.00

Neutral

- **Leading Ethernet switch ODM.** Accton is a globally leading open-sourced based networking equipment ODM, and an early mover supporting the OCP take-off from the onset. We believe its leadership will further widen against peers, supported by comprehensive knowledge in hardware design, cost-efficient production and strong testing know-how, presenting the company as the key beneficiary of the favourable industry trend in faster speed ports migration, and new demand from 5G proliferation and new customers.
- **ODM Direct proliferation continues, but 400G adoption push-out amid COVID-19.** We believe ODM Direct in networking should catch up with server/storage on the proliferation of OCP long term, while 400G speed port migration by hyperscalers will accelerate the trend, in our view. Nevertheless, based on our industry checks, we see push-out in 400G migration at Accton's existing customer (Amazon) and delay entering into new customer (Microsoft), despite Facebook having started 400G upgrade in 2019. We now forecast its cloud sales (including smart NIC) to remain more flattish for +1.5% YoY in 2020E, before rebounding to 22% and 18% YoY growth in 2021/22E, as impacts from COVID-19 subside. Lastly, we see 5G proliferation driving incremental demand uptick on open-sourced platform proliferation and higher speed requirement at the edge and data-centre with telcos, but the contribution will be limited in the near term.
- **ODM business also weakening on softer macro.** Aside from cloud, we continue to expect Accton to gain share in its ODM business, at the expense of a Taiwanese peer. However, we see weakening enterprise demand becoming a key headwind into 2H20 and 2021 due to softer macro-economic outlook amid COVID-19, as corporates manage and optimise their spending. Overall, we forecast its ODM sales to decline 12% YoY in 2020E, before the business normalises to 11-12% YoY growth in 2021/22E.
- **Retain NEUTRAL.** We maintain our target price at NT$240 based on 20x 2021E P/E (from 18x 2021E) and peak multiple in the last three years. Accton's shares have appreciated by nearly 90% since its trough in mid-March, as we see limited upsides on weaker enterprise demand, slower ramp on new customer, and 400G push-out amid COVID-19. We stay NEUTRAL and will continue to monitor the impacts from COVID-19, and progress of new hyperscale customer and 400G projects ramp, to look for a better entry point.

Price (17 Jul 20, NT$)	236.50
Upside/downside (%)	1.5
Mkt cap (NT$/US$ mn)	132,089 / 4,485
Enterprise value (NT$ mn)	121,776
Number of shares (mn)	558.52
Free float (%)	75.3
52-wk price range (NT$)	262-133
ADTO-6M (US$ mn)	48.2

Research Analysts

Jerry Su
886 2 2715 6361
jerry.su@credit-suisse.com

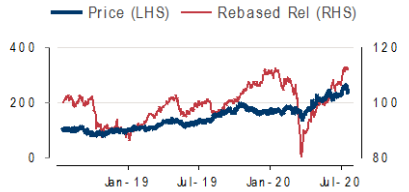
Harvie Chou
886 2 2715 6364
harvie.chou@credit-suisse.com

Financial and valuation metrics

Year	12/19A	12/20E	12/21E	12/22E
Revenue (NT$ mn)	55,401.0	54,198.3	63,866.6	73,774.2
EBITDA (NT$ mn)	6,579.3	6,797.9	9,008.5	10,831.7
EBIT (NT$ mn)	6,040.0	6,103.9	8,118.0	9,791.0
Net profit (NT$ mn)	4,950.5	5,075.6	6,613.2	7,776.3
EPS (CS adj.) (NT$)	8.87	9.09	11.84	13.92
Chg. from prev. EPS (%)	n.a.	0.0	0.0	0.0
Consensus EPS (NT$)	n.a.	9.33	11.91	15.18
EPS growth (%)	67.3	2.4	30.3	17.6
P/E (x)	26.6	26.0	20.0	17.0
Dividend yield (%)	2.6	2.9	3.8	4.4
EV/EBITDA (x)	19.3	17.3	12.8	9.8
P/B (x)	9.86	9.2	7.7	5.3
ROE (%)	41.2	36.6	42.0	36.9
Net debt/equity (%)	(41.4)	(100.2)	(98.7)	(102.4)

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17/07/20. On 17/07/20 the spot exchange rate was NT$29.45/US$1

Performance	1M	3M	12M
Absolute (%)	5.3	14.8	84.0
Relative (%)	(0.3)	(0.1)	71.2

Accton (2345.TW / 2345 TT)

Price (17 Jul 2020): **NT$236.50** Target Price: **NT$240.00**

Analyst: **Jerry Su**

Rating: **Neutral**

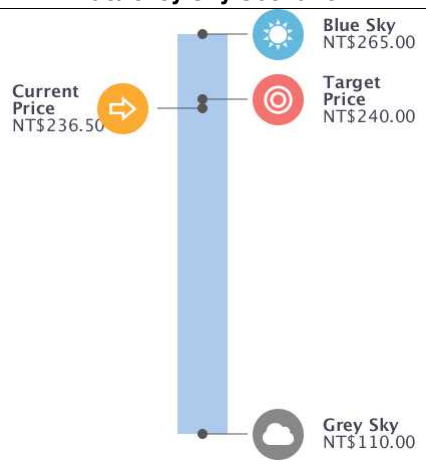
Income Statement (NT$ mn)	12/19A	12/20E	12/21E	12/22E
Sales revenue	**55,401**	**54,198**	**63,867**	**73,774**
Cost of goods sold	44,402	43,295	50,708	58,438
EBITDA	**6,579**	**6,798**	**9,008**	**10,832**
EBIT	**6,040**	**6,104**	**8,118**	**9,791**
Net interest expense/(inc.)	(82)	(137)	(188)	(244)
Recurring PBT	**6,130**	**6,378**	**8,292**	**10,031**
Profit after tax	**4,950**	**5,076**	**6,613**	**7,976**
Reported net profit	**4,950**	**5,076**	**6,613**	**7,776**
Net profit (Credit Suisse)	**4,950**	**5,076**	**6,613**	**7,776**
Balance Sheet (NT$ mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Cash & cash equivalents	6,222	15,491	18,046	26,655
Current receivables	7,125	8,554	9,976	11,732
Inventories	8,717	8,195	7,918	9,297
Other current assets	4,985	494	518	609
Current assets	**27,049**	**32,734**	**36,458**	**48,293**
Property, plant & equip.	1,324	2,033	2,377	2,021
Investments	231	187	187	187
Intangibles	55	0	0	0
Other non-current assets	861	1,152	1,152	1,152
Total assets	**29,521**	**36,106**	**40,175**	**51,654**
Current liabilities	**15,238**	**20,889**	**22,152**	**25,855**
Total liabilities	**16,718**	**21,750**	**23,013**	**26,715**
Total debt	921	1,109	1,109	1,109
Shareholders' equity	**13,390**	**14,353**	**17,159**	**24,936**
Minority interests	0	0	0	0
Total liabilities & equity	**29,521**	**36,106**	**40,175**	**51,654**
Cash Flow (NT$ mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
EBIT	**6,040**	**6,104**	**8,118**	**9,791**
Net interest	0	0	0	0
Tax paid	0	0	0	0
Working capital	3,293	3,461	93	477
Other cash & non-cash items	(548)	(334)	(614)	(973)
Operating cash flow	**8,785**	**9,231**	**7,597**	**9,294**
Capex	(779)	(1,345)	(1,200)	(650)
Free cash flow to the firm	**8,006**	**7,886**	**6,397**	**8,644**
Investing cash flow	**(3,068)**	**(4,284)**	**(3,636)**	**(1,986)**
Equity raised	5	5	0	0
Dividends paid	(2,231)	(3,460)	(3,807)	(4,960)
Financing cash flow	**2,898**	**757**	**0**	**0**
Total cash flow	**8,615**	**5,704**	**3,962**	**7,309**
Adjustments	0	0	0	0
Net change in cash	**8,615**	**5,704**	**3,962**	**7,309**
Per share	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Shares (wtd avg.) (mn)	558	559	559	559
EPS (Credit Suisse) (NT$)	**8.87**	**9.09**	**11.84**	**13.92**
DPS (NT$)	6.20	6.82	8.88	10.44
Operating CFPS (NT$)	15.75	16.53	13.60	16.64
Earnings	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Growth (%)				
Sales revenue	28.6	(2.2)	17.8	15.5
EBIT	73.9	1.1	33.0	20.6
EPS	67.3	2.4	30.3	17.6
Margins (%)				
EBITDA	11.9	12.5	14.1	14.7
EBIT	10.9	11.3	12.7	13.3
Valuation (x)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
P/E	26.6	26.0	20.0	17.0
P/B	9.86	9.20	7.70	5.30
Dividend yield (%)	2.6	2.9	3.8	4.4
EV/sales	2.3	2.2	1.8	1.4
EV/EBITDA	19.3	17.3	12.8	9.8
EV/EBIT	21.0	19.3	14.2	10.9
ROE analysis (%)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
ROE	41.2	36.6	42.0	36.9
ROIC	72.3	130.0	6548.3	(4061.8)
Credit ratios	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Net debt/equity (%)	(41.4)	(100.2)	(98.7)	(102.4)
Net debt/EBITDA (x)	(0.81)	(2.12)	(1.88)	(2.36)

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Founded in October 1988, Accton is a leading open-source networking ODM/OEM partner for global top-tier players with particular specialisation in data centre, carrier access and campus networks.

Blue/Grey Sky Scenario



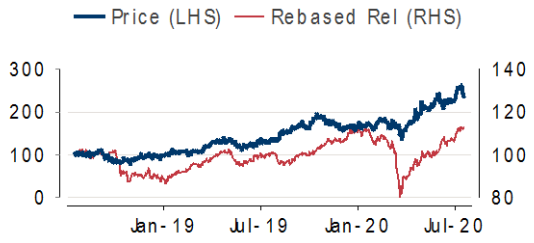
Our Blue Sky Scenario (NT$) **265.00**

In the blue sky scenario, our blue sky value of NT$265 is based on 22x P/E, the peak multiple of the past three years, as we assume faster speed migration from Facebook and Amazon; better progress with new hyperscalers ramp and incremental contribution from the 5G take-off.

Our Grey Sky Scenario (NT$) **110.00**

In the grey sky scenario, our grey sky value of NT$110 is based on 11x P/E, its trough multiple of the past three year, as assume prolonged speed migration from Facebook and Amazon; and slower progress with new hyperscalers ramp and incremental contribution from the 5G take-off.

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17-Jul-2020

On 17-Jul-2020 the spot exchange rate was NT$29.45/US$1

CREDIT SUISSE

Advanced Micro Devices, Inc.

Beneficiary of rising compute tide

AMD

Target price (12M, US$)
33.00
Neutral[V]

Semiconductor Devices

- **Growth beyond Gaming.** AMD has two reportable segments of revenue: (1) Computing and Graphics (C&G) is 70% of revenue, which primarily includes desktop and notebook processors and chipsets, discrete and integrated graphics processing units (GPUs), data centre and professional GPUs and development services, and (2) Enterprise, Embedded and Semi-Custom segment (EESC) is 30% of revenue, and primarily includes server and embedded processors, semi-custom System-on-Chip (SoC) products, development services and technology for game consoles—thus both include components of data centres.
- **High-growth data centre expanding into infrastructure.** Recently at the Analyst Day 2019, AMD announced it was on track to achieve double-digit market share in Data Centre by 2Q20 and expects third Gen Epyc (shipping 2H20) to cover 100% of workloads up from ~80% in the second Gen. The company reiterated $19B Server TAM, $11B GPU TAM, and $5B Telco/Infra TAM leading to a high growth $35B high growth TAM by 2023. Within Data Centre, AMD expects its revenue balance to remain stable at ~50% Cloud, ~35% enterprise, and ~15% HPC. For the first time, AMD addressed the 5G Telco/Infra market as an opportunity for expansion in 5G base stations and highlighted recent successes with Nokia (Epyc Core 2x faster than competitors).
- **Outlook for 2020/21.** For CY20/21, we expect Rev/EPS of US$8.4 bn/$1.00 and US$10 bn/$1.35—by segment: (1) Within C&G, Computing is growing at +21%/16% YoY and in (2) EESC, server is growing at +124%/12% YoY. During F1Q20, AMD revised its guidance for CY20 revenue to +20-30% YoY, midpoint of +25% YoY—which is lower than the original guidance of up 28-30% YoY. However, GM target remains at~45%, in line with CS and the original guidance of ~45%.
- **Valuation embeds significant share gains.** The bull narrative centres on Epyc Server market share gains especially in 2H19 into 2020. We oscillate between rich valuation/high expectations and our view that investors continue to underestimate the LT Compute TAM. AMD currently trades at 51.7x NTM P/E. While below its three-year average of 54.4x, AMD is trading at a 181% premium to the SOX. While we expect AMD to take modest share, we believe that INTC's investment over AMD creates a strong competitive moat.

Price (17 Jul 20, US$)	55.04
52-week price range	58.90 - 27.99
Market cap (US$ m)	64,462.32
Enterprise value (US$ m)	62,966

[V] = Stock Considered Volatile (see Disclosure Appendix)

Research Analysts

John W. Pitzer
212 538 4610
john.pitzer@credit-suisse.com

Dalya Hahn
212 325 7843
dalya.hahn@credit-suisse.com

Eric Hu
212 325 4735
eric.hu@credit-suisse.com

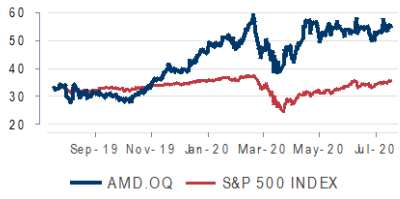
Jerome Darling
212 325 3211
jerome.darling@credit-suisse.com

Financial and valuation metrics

Year		12/19A	12/20E	12/21E
EPS (Excl. ESO) (US$)		0.63	1.00	1.35
Prev. EPS (Excl. ESO., US$)		-	-	-
EPS (CS adj.,)		0.50	0.83	1.18
P/E (Excl. ESO.) (x)		88.0	54.8	40.7
P/E rel. (Excl. ESO., %)		451.4	217.1	208.8
Revenue (US$ m)		6,731.0	8,416.0	9,990.0
Net Debt (US$ m)		-1,017	-1,496	-1,943
OCFPS (US$)		0.31	0.60	0.64
P/OCF (x)		176.9	91.2	85.7
Number of shares (m)	1,171.19	Price/Sales (x)		8.78
BV/share (Next Qtr., US$)	.8	P/BVPS (x)		20.9
Net debt (Next Qtr., US$ m)	403.0	Dividend (current, US$)		-
Dividend yield (%)	-			

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$32.51

Quarterly EPS	Q1	Q2	Q3	Q4
2019A	0.05	0.08	0.18	0.31
2020E	0.18	0.16	0.30	0.36
2021E	0.28	0.31	0.37	0.39

Advanced Micro Devices, Inc. (AMD)

Price (17 Jul 2020): **US$55.04** Target Price: **33.00**

Analyst: **John Pitzer**
Rating: **Neutral [V]**

Income Statement	12/19A	12/20E	12/21E
Revenue (US$ m)	**6,731.0**	**8,416.0**	**9,990.0**
EBITDA	**1,062.0**	**1,324.1**	**1,786.1**
Operating profit	**840.0**	**1,324.1**	**1,786.1**
Recurring profit	**739.0**	**1,275.1**	**1,730.1**
Cash Flow	**12/19A**	**12/20E**	**12/21E**
Cash flow from operations	**376**	**744**	**796**
CAPEX	(217)	(287)	(350)
Free cash flow to the firm	**159**	**457**	**447**
Cash flow from investments	**(181)**	**(269)**	**(350)**
Net share issue(/repurchase)	35	0	0
Dividends paid	0	0	0
Issuance (retirement) of debt	(234)	0	0
Other	447	2	0
Cash flow from financing activities	248	2	0
Effect of exchange rates	-	-	-
Changes in Net Cash/Debt	**1,111**	**479**	**447**
Net debt at end	(1,017)	(1,496)	(1,943)
Balance Sheet ($US)	**12/19A**	**12/20E**	**12/21E**
Assets			
Other current assets	253	258	258
Total current assets	**4,597**	**5,087**	**5,721**
Total assets	**6,028**	**6,583**	**7,287**
Liabilities			
Short-term debt	0	0	0
Total current liabilities	2,359	2,202	2,260
Long-term debt	486	488	488
Total liabilities	3,201	3,044	3,102
Shareholder equity	2,827	3,539	4,185
Total liabilities and equity	**6,028**	**6,583**	**7,287**
Net debt	(1,017)	(1,496)	(1,943)
Per share	**12/19A**	**12/20E**	**12/21E**
No. of shares (wtd avg)	1,208	1,232	1,240
CS adj. EPS	0.50	0.83	1.18
Prev. EPS (US$)	-	-	-
Dividend (US$)	0.00	0.00	1.00
Free cash flow per share	0.13	0.37	0.36
Earnings	**12/19A**	**12/20E**	**12/21E**
Sales growth (%)	4.0	25.0	18.7
Net profit growth (%)	61.8	66.7	43.4
EPS growth (%)	53.4	63.3	42.3
EBIT margin (%)	12.5	15.7	17.9
Valuation	**12/19A**	**12/20E**	**12/21E**
EV/Sales (x)	9.43	7.48	6.26
EV/EBIT (x)	75.5	47.6	35.0
P/E (x)	109.0	66.7	46.8

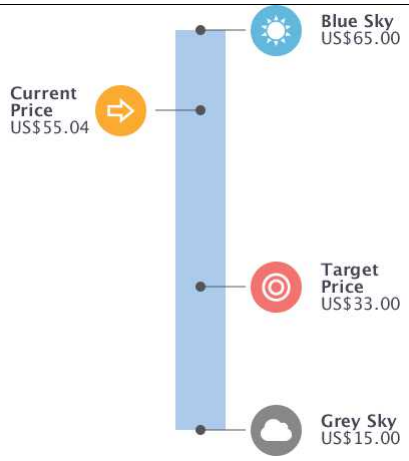
Quarterly EPS	Q1	Q2	Q3	Q4
2019A	0.05	0.08	0.18	0.31
2020E	0.18	0.16	0.30	0.36
2021E	0.28	0.31	0.37	0.39

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Advanced Micro Devices, Inc. (AMD) is a global semiconductor company. The company primarily offers x86 microprocessors, embedded microprocessors and chipsets for desktop and notebook personal computers (PCs), professional workstations and servers.

Blue/Grey Sky Scenario



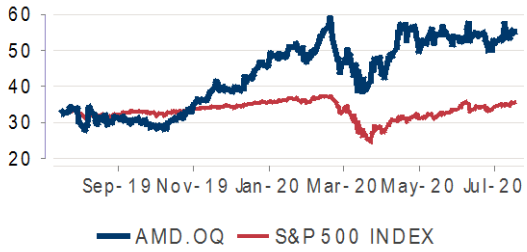
Our Blue Sky Scenario (US$) **65.00**

Our blue sky scenario of US$65 assumes AMD exceeds its LT operating target, and gains sustainable market share in MPUs and GPUS—supporting LT EPS >U$2.00 and implying a value of US$65 at 38x P/E.

Our Grey Sky Scenario (US$) **15.00**

Our grey sky scenario of US$15 assumes AMD is not able to achieve its LT operating target, and does not achieve meaningful market share in MPUs and GPUs—supporting LT EPS US$1.00 and implying a value of US$15 at 15x P/E.

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73
Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$32.51

CREDIT SUISSE

Alchip Tech

Taiwan IC design service proxy China CPU proxy in Taiwan

3661.TW

Target price (12M, NT$)
630.00

Outperform[V]

Semiconductor Devices

- **IC design service proxy for China semiconductor growth.** We are initiating coverage on Alchip with an OUTPERFORM rating and a target price of NT$425. Alchip is an IC design service company based in Taiwan and has a strong R&D team in China, with a focus on the projects including HPC and AI on the advanced nodes. The company's sales saw a meaningful growth in 2019 supported by China CPU ramp for PC adopted by the local government and SOE and tape out of the AI project. We believe the company's sales should see a 30% CAGR from 2019-22 on more HPC and AI projects from its China and US customers.
- **Key beneficiary from China CPU substitution.** Alchip has been working more aggressively with Phytium, a leading CPU fabless in China, on ARM-based processor for PC/NB and server since 2014. The PC CPU project on 16nm has started mass production in 2H19 and the server CPU project is also on track for production in 2H20 as China is replacing CPU for government and SOE applications with its own solutions for technology control. With higher China CPU adoption, we estimate the sales from China CPU mass production will likely contribute 35-40% of Alchip's sales in 2020 and 50% in 2021 as local CPU penetration rises. The company also generates about 10% of sales from supercomputing, with a China project on 7nm booking $50 mn in late 20/early 21.
- **Growing AI projects as second growth engine.** We believe Alchip's AI customer base is diversified, leveraging its experience in HPC. We believe the company has worked on Amazon's projects (Inferentia on 16nm and Graviton on 7nm) and leading AI start-ups including Habana (inference and training—acquired by Intel) and Astera Labs (PCIe-5 re-timer invested by Intel), supporting the company's NRE and turnkey business growth.
- **Healthy growth and operating leverage supports upper half valuation.** On the growing China CPU and AI market opportunity, we model the company's EPS at NT$15.50/NT$21.00 in 2020/2021. Our target price of NT$630 is based on 30x of 2021 P/E, at the upper half of its 10-30x range, factoring in a more predictable project pipeline in the next few years and potential upside from China CPU demand (vs. valuation surge on cryptocurrency demand in 2017). Key risks: delay in AI investment, slower-than-expected China CPU penetration, China customers' shift to foundry direct business model.

Price (17 Jul 20, NT$)	480.00
Upside/downside (%)	31.3
Mkt cap (NT$/US$ mn)	29,437 / 999
Enterprise value (NT$ mn)	26,478
Number of shares (mn)	61.33
Free float (%)	73.7
52-wk price range (NT$)	575-96.20
ADTO-6M (US$ mn)	67.1

[V] = Stock Considered Volatile (see Disclosure Appendix)

Research Analysts

Haas Liu
886 2 2715 6365
haas.liu@credit-suisse.com

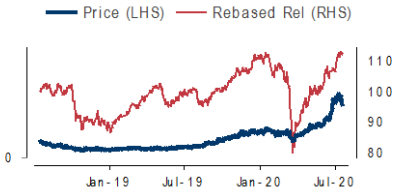
Randy Abrams, CFA
886 2 2715 6366
randy.abrams@credit-suisse.com

Financial and valuation metrics

Year	12/18A	12/19E	12/20E	12/21E
Revenue (NT$ mn)	3,450.7	4,332.0	6,716.9	8,671.5
EBITDA (NT$ mn)	1,108.0	1,361.6	2,337.8	2,786.9
EBIT (NT$ mn)	321.9	432.9	1,098.8	1,518.8
Net profit (NT$ mn)	257.4	433.5	939.8	1,273.8
EPS (CS adj.) (NT$)	4.2	7.22	15.5	21.0
Chg. from prev. EPS (%)	n.a.	0.0	0.0	0.0
Consensus EPS (NT$)	n.a.	7.2	12.12	17.01
EPS growth (%)	(17.4)	71.9	114.5	35.5
P/E (x)	114.2	66.4	31.0	22.9
Dividend yield (%)	0.2	0.3	0.7	1.5
EV/EBITDA (x)	24.7	19.5	11.3	9.3
P/B (x)	10.07	8.72	7.23	5.97
ROE (%)	9.1	13.9	25.6	28.6
Net debt/equity (%)	(71.3)	(85.4)	(76.3)	(74.5)

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17/07/20. On 17/07/20 the spot exchange rate was NT$29.45/US$1

Performance	1M	3M	12M
Absolute (%)	31.0	101.7	435.7
Relative (%)	25.4	86.7	422.9

Alchip Tech (3661.TW / 3661 TT)

Price (17 Jul 2020): **NT$480.00** Target Price: **NT$630.00**

Analyst: **Haas Liu**

Rating: **Outperform [V]**

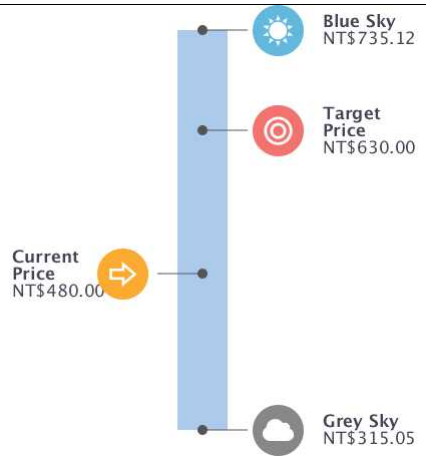
Income Statement (NT$ mn)	12/18A	12/19E	12/20E	12/21E
Sales revenue	**3,451**	**4,332**	**6,717**	**8,671**
Cost of goods sold	2,159	2,721	4,384	5,713
EBITDA	**1,108**	**1,362**	**2,338**	**2,787**
EBIT	**322**	**433**	**1,099**	**1,519**
Net interest expense/(inc.)	(45)	(52)	(51)	(51)
Recurring PBT	**335**	**525**	**1,191**	**1,615**
Profit after tax	**257**	**434**	**940**	**1,274**
Reported net profit	**257**	**434**	**940**	**1,274**
Net profit (Credit Suisse)	**257**	**434**	**940**	**1,274**
Balance Sheet (NT$ mn)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Cash & cash equivalents	1,765	2,480	2,734	3,295
Current receivables	671	898	1,540	1,911
Inventories	281	582	605	722
Other current assets	167	148	190	227
Current assets	**2,884**	**4,108**	**5,069**	**6,155**
Property, plant & equip.	317	389	599	808
Investments	319	354	354	354
Intangibles	147	222	222	222
Other non-current assets	51	151	151	151
Total assets	**3,717**	**5,225**	**6,396**	**7,691**
Current liabilities	**769**	**1,816**	**2,259**	**2,703**
Total liabilities	**797**	**1,923**	**2,366**	**2,811**
Total debt	0	15	15	15
Shareholders' equity	**2,921**	**3,302**	**4,029**	**4,880**
Minority interests	0	0	0	0
Total liabilities & equity	**3,717**	**5,225**	**6,396**	**7,691**
Cash Flow (NT$ mn)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
EBIT	**322**	**433**	**1,099**	**1,519**
Net interest	0	0	0	0
Tax paid	(77)	(92)	(251)	(342)
Working capital	(391)	(248)	(616)	(391)
Other cash & non-cash items	1,166	1,572	1,682	1,675
Operating cash flow	**1,020**	**1,664**	**1,915**	**2,461**
Capex	(712)	(511)	(1,000)	(1,000)
Free cash flow to the firm	**307**	**1,154**	**915**	**1,461**
Investing cash flow	**(1,258)**	**(295)**	**(1,448)**	**(1,478)**
Equity raised	(158)	0	0	0
Dividends paid	(64)	(91)	(212)	(423)
Financing cash flow	**(224)**	**(76)**	**(212)**	**(423)**
Total cash flow	**(463)**	**1,293**	**254**	**561**
Adjustments	43	(58)	0	0
Net change in cash	**(420)**	**1,235**	**254**	**561**
Per share	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Shares (wtd avg.) (mn)	61	60	61	61
EPS (Credit Suisse) (NT$)	**4.20**	**7.22**	**15.50**	**21.00**
DPS (NT$)	1.07	1.53	3.50	6.97
Operating CFPS (NT$)	16.65	27.74	31.57	40.58
Earnings	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Growth (%)				
Sales revenue	(19.1)	25.5	55.1	29.1
EBIT	0.6	34.5	153.8	38.2
EPS	(17.4)	71.9	114.5	35.5
Margins (%)				
EBITDA	32.1	31.4	34.8	32.1
EBIT	9.3	10.0	16.4	17.5
Valuation (x)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
P/E	114.2	66.4	31.0	22.9
P/B	10.07	8.72	7.23	5.97
Dividend yield (%)	0.2	0.3	0.7	1.5
EV/sales	7.9	6.1	3.9	3.0
EV/EBITDA	24.7	19.5	11.3	9.3
EV/EBIT	85.0	61.5	24.0	17.0
ROE analysis (%)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
ROE	9.1	13.9	25.6	28.6
ROIC	33.4	54.1	120.6	108.8
Credit ratios	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Net debt/equity (%)	(71.3)	(85.4)	(76.3)	(74.5)
Net debt/EBITDA (x)	(1.88)	(2.07)	(1.31)	(1.30)

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Headquartered in Taipei, Alchip has a footprint around the major semiconductor markets to provide its local customers with real time service, including a Japan office set up in 2003, Wuxi in 2010, Hefei in 2016, Guangzhou in 2017 and Jinan in 2018.

Blue/Grey Sky Scenario



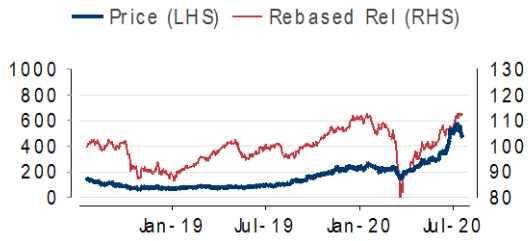
Our Blue Sky Scenario (NT$) **735.12**

Our blue sky scenario implies value can be up to NT$735.12 on the back of stronger-than-expected China CPU demand or faster-than-expected AI and 5G project development.

Our Grey Sky Scenario (NT$) **315.05**

Our grey sky scenario implies value can be at NT$315.05 if there is weaker-than-expected China CPU demand or its customers fail to deliver on AI or 5G networking projects.

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17-Jul-2020
On 17-Jul-2020 the spot exchange rate was NT$29.45/US$1

CREDIT SUISSE

Aspeed

Consolidating share in servers and expanding into networking

5274.TWO

Target price (12M, NT$)
1,300
Outperform[V]

Semiconductor Equipment

- **Technology leader in server BMC market.** Aspeed has been dominant in its core Baseboard Management Controller (BMC) at 90% of sales, with 60-65% market share. The company supplies almost all of the major hyperscale customers through the Taiwan ODMs and has grown to 35% enterprise server share following its acquisition of Broadcom's Emulex Pilot division. The rest of the 10% sales are from A/V extension SoC compressing video signal to display on remote signage, iCafe chipset solution enabling the operators to move the expensive gaming hardware to a back server closet and Cupola 360 degree camera capable of stitching 6 camera into a 30fps 4k2k stream.
- **2020 still strong on a low 1H20 compare despite 2H20 slowdown.** We believe some of its customers in both the US and China are now trimming some orders after the inventory build-up in 1H20. We expect Aspeed's BMC business to slow down in 2H20 due to hyperscaler customers' inventory overbuilds in 1H20. Despite a slower 2H20, we still expect the company's 2020 sales to grow 28% YoY, with growth lifted from easy 1H19 compares and good cloud momentum mainly from BMC into server and some attached to switch/networking with non-BMC 5-10% of sales.
- **Opportunity from new customer wins and edge server penetration support growth in 2021.** We believe the company has drivers in 2021, including share gains in new cloud customers by 2H21 and more units into storage, switch and 5G Edge servers (incremental 5-10% of units). Some data centre capex will also be deferred due to lockdown constraints, lifting Aspeed's opportunity in 2021.
- **A pullback sets up an opportunity in a long-term growth story.** We maintain 2020/21 EPS at NT$30.50/NT$37.00 and stay OUTPERFORM with an NT$1,300 TP based on 35x 21E P/E, the high-end of its range. The stock may stay volatile with 2H20 orders having risk of a 1-2 quarter inventory digestion, followed by another leg up on market growth and share gains in 2021.

Price (17 Jul 20, NT$)	1,255
Upside/downside (%)	3.6
Mkt cap (NT$/US$ mn)	42,952 / 1,458
Enterprise value (NT$ mn)	40,967
Number of shares (mn)	34.22
Free float (%)	65.4
52-wk price range (NT$)	1,550-653
ADTO-6M (US$ mn)	21.0

[V] = Stock Considered Volatile (see Disclosure Appendix)

Research Analysts

Randy Abrams, CFA
886 2 2715 6366
randy.abrams@credit-suisse.com

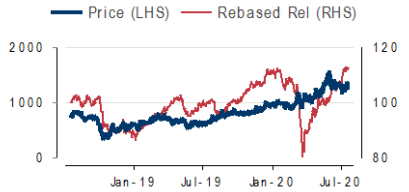
Haas Liu
886 2 2715 6365
haas.liu@credit-suisse.com

Financial and valuation metrics

Year	12/18A	12/19E	12/20E	12/21E
Revenue (NT$ mn)	2,153.5	2,484.3	3,187.6	3,698.3
EBITDA (NT$ mn)	938.1	1,150.2	1,450.7	1,704.2
EBIT (NT$ mn)	799.9	1,008.3	1,308.4	1,561.9
Net profit (NT$ mn)	685.9	831.6	1,043.2	1,265.5
EPS (CS adj.) (NT$)	20.2	24.39	30.5	37.0
Chg. from prev. EPS (%)	n.a.	0.0	0.0	0.0
Consensus EPS (NT$)	n.a.	24.28	31.17	40.52
EPS growth (%)	28.7	20.7	25.1	21.3
P/E (x)	62.1	51.5	41.1	33.9
Dividend yield (%)	1.2	1.4	1.6	2.1
EV/EBITDA (x)	44.4	35.8	28.1	23.6
P/B (x)	18.29	21.05	18.12	15.62
ROE (%)	31.1	38.1	47.4	49.5
Net debt/equity (%)	(54.2)	(89.3)	(89.6)	(98.7)

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17/07/20. On 17/07/20 the spot exchange rate was NT$29.45/US$1

Performance	1M	3M	12M
Absolute (%)	(4.2)	15.7	97.0
Relative (%)	(9.8)	0.7	84.2

CREDIT SUISSE

Aspeed (5274.TWO / 5274 TT)

Price (17 Jul 2020): **NT$1,255**

Target Price: **NT$1,300**

Analyst: **Randy Abrams**

Rating: **Outperform [V]**

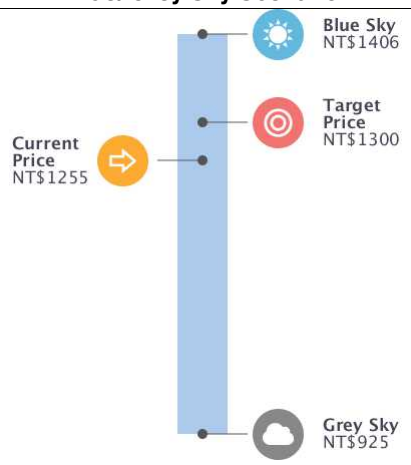
Income Statement (NT$ mn)	12/18A	12/19E	12/20E	12/21E
Sales revenue	**2,154**	**2,484**	**3,188**	**3,698**
Cost of goods sold	864	913	1,194	1,377
EBITDA	**938**	**1,150**	**1,451**	**1,704**
EBIT	**800**	**1,008**	**1,308**	**1,562**
Net interest expense/(inc.)	(13)	(4)	0	0
Recurring PBT	**854**	**1,037**	**1,309**	**1,582**
Profit after tax	**686**	**832**	**1,043**	**1,265**
Reported net profit	**686**	**832**	**1,043**	**1,265**
Net profit (Credit Suisse)	**686**	**832**	**1,043**	**1,265**
Balance Sheet (NT$ mn)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Cash & cash equivalents	1,262	1,815	2,122	2,713
Current receivables	401	582	586	762
Inventories	139	100	100	100
Other current assets	17	33	33	43
Current assets	**1,819**	**2,530**	**2,840**	**3,617**
Property, plant & equip.	85	110	156	202
Investments	0	0	0	0
Intangibles	886	823	823	823
Other non-current assets	43	93	93	93
Total assets	**2,833**	**3,555**	**3,912**	**4,735**
Current liabilities	**424**	**1,446**	**1,466**	**1,911**
Total liabilities	**504**	**1,522**	**1,543**	**1,987**
Total debt	0	0	0	0
Shareholders' equity	**2,329**	**2,033**	**2,369**	**2,748**
Minority interests	0	0	0	0
Total liabilities & equity	**2,833**	**3,555**	**3,912**	**4,735**
Cash Flow (NT$ mn)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
EBIT	**800**	**1,008**	**1,308**	**1,562**
Net interest	0	0	0	0
Tax paid	0	0	0	0
Working capital	(110)	(82)	(3)	(79)
Other cash & non-cash items	89	354	(163)	29
Operating cash flow	**779**	**1,280**	**1,143**	**1,512**
Capex	(75)	(66)	(87)	(87)
Free cash flow to the firm	**704**	**1,215**	**1,055**	**1,425**
Investing cash flow	**(7)**	**(494)**	**(164)**	**(163)**
Equity raised	0	0	0	0
Dividends paid	(510)	(616)	(707)	(887)
Financing cash flow	**(560)**	**(618)**	**(707)**	**(887)**
Total cash flow	**212**	**169**	**272**	**462**
Adjustments	27	6	0	0
Net change in cash	**239**	**175**	**272**	**462**
Per share	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Shares (wtd avg.) (mn)	34	34	34	34
EPS (Credit Suisse) (NT$)	**20.20**	**24.39**	**30.50**	**37.00**
DPS (NT$)	15.01	18.05	20.67	25.93
Operating CFPS (NT$)	22.95	37.55	33.41	44.21
Earnings	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Growth (%)				
Sales revenue	13.7	15.4	28.3	16.0
EBIT	23.5	26.1	29.8	19.4
EPS	28.7	20.7	25.1	21.3
Margins (%)				
EBITDA	43.6	46.3	45.5	46.1
EBIT	37.1	40.6	41.0	42.2
Valuation (x)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
P/E	62.1	51.5	41.1	33.9
P/B	18.29	21.05	18.12	15.62
Dividend yield (%)	1.2	1.4	1.6	2.1
EV/sales	19.4	16.6	12.8	10.9
EV/EBITDA	44.4	35.8	28.1	23.6
EV/EBIT	52.1	40.8	31.2	25.8
ROE analysis (%)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
ROE	31.1	38.1	47.4	49.5
ROIC	62.3	125.9	448.5	883.8
Credit ratios	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Net debt/equity (%)	(54.2)	(89.3)	(89.6)	(98.7)
Net debt/EBITDA (x)	(1.35)	(1.58)	(1.46)	(1.59)

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Aspeed is a fabless design house focusing on system on chip solutions for the data centre and advanced multimedia applications, due to senior management's extensive background in PC chipsets and graphics.

Blue/Grey Sky Scenario



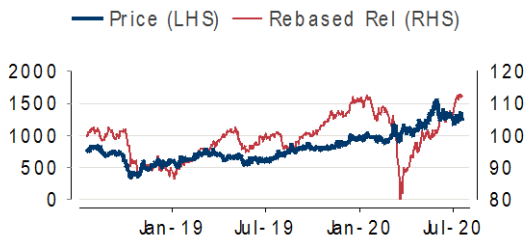
Our Blue Sky Scenario (NT$) **1,406**

Our blue sky valuation scenario of NT$1,406 implies 38x 2021 P/E based on further gains in BMC in servers and networking and solid traction of its new products.

Our Grey Sky Scenario (NT$) **925.07**

Our grey sky valuation scenario of NT$925 implies 25x 2021 P/E based on slowing server growth, limited further share gains, and little traction on its new products.

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17-Jul-2020
On 17-Jul-2020 the spot exchange rate was NT$29.45/US$1

CREDIT SUISSE

Broadcom Ltd

Softconductor or Semiware: either way AVGO is undervalued

AVGO

Target price (12M, US$)
400.00

Outperform

Semiconductor Devices

- **Datacentre growth in wired/data transmission.** We expect Wired Rev (~36% of Rev) growth to re-accelerate from what has been a -0.5% CAGR contraction to what is likely to be a 6-8% CAGR expansion. Despite its reset in CY19 as enterprise data centre spending paused in 2H19 and increased worries about Cisco's transition from customer to competitor in the ASIC market, we see MSD growth driven by AVGO maintaining leadership positions in its diverse, wired product portfolio without high exposure to cloud and data centres.
- **Broadcom may maintain in-line to above growth in networking.** Overall, we expect Networking spend to grow at a 5.7% CAGR through 2024—with Cloud spend at nearly ~11% CAGR—leading to Datacentre Networking TAM of US$24.5 bn. We expect Wired Rev to grow at least in-line with this MSD Datacentre Networking TAM as AVGO's products are more levered to the higher growth Cloud segment.
- **Upside from Infrastructure & Networking (~US$38 bn SAM):** We estimate growth from (1) Data Centre Ethernet switch SAM growth at a 10% CAGR to >$23 bn by 2023, with AVGO the segment leader driven by Cloud/Data Centre expansion; (2) Service Provider equipment SAM growth at a 7% CAGR to $38 bn in 2023; (3) higher-performance interconnect (10G to 40G); and (4) Wireless Infrastructure (4G to 5G upgrades). Growth in Ethernet switches and PHYs is driven by (1) build outs of packet-based networks for the delivery of video and mobile data over the Internet, (2) an increase in hosted services and cloud computing, (3) growth in unified communications in the enterprise, and (4) share gains.
- **Outlook CY20/21:** We expect CY20/21 Rev/EPS of US$23.9 bn/US$22.04 and US$25.3 bn/US$24.65 (+5.3%/6.1% YoY) and have established a 12-month TP of US$400. Our methodology combines a CY21 EV/FCF multiple and SOTP's framework: (1) we model CY21 FCF of US$11.4 bn, (2) we assume a 70%/30% FCF split between Semiconductor Solutions (US$8 bn) and Infrastructure Software (US$3.4 bn), (3) we apply a ~21x EV/FCF multiple on Semi Solutions business—a ~15% discount to the SOX in-line with 3/5-year average discount), and (4) we apply a ~15x EV/FCF multiple on Infrastructure Software in line with the combined multiples of CA and SYMC over the last 3/5 years. In aggregate, this implies the total EV of ~US$215 bn or ~US$400 per share over the next 12 months. At US$400 the stock would be trading at CY20/21 EV/FCF 21.6x/18.6x.

Price (17 Jul 20, US$)	312.71
52-week price range	327.80 - 167.87
Market cap (US$ m)	141,887.56
Enterprise value (US$ m)	178,184

Research Analysts

John W. Pitzer
212 538 4610
john.pitzer@credit-suisse.com

Dalya Hahn
212 325 7843
dalya.hahn@credit-suisse.com

Eric Hu
212 325 4735
eric.hu@credit-suisse.com

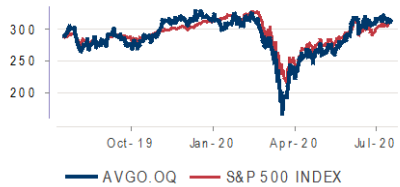
Jerome Darling
212 325 3211
jerome.darling@credit-suisse.com

Financial and valuation metrics

Year		10/19A	10/20E	10/21E
EPS (Excl. ESO) (US$)		21.30	21.50	24.34
EPS (CS adj.,)		21.30	21.50	24.15
Prev. EPS (CS adj., US$)		-	-	-
P/E (CS adj.) (x)		14.7	14.5	12.9
P/E rel. (CS adj., %)		75.3	57.6	66.5
Revenue (US$ m)		22,597.0	23,595.0	25,050.0
Net Debt (US$ m)		27,743	36,297	32,092
OCFPS (US$)		21.85	22.23	26.11
P/OCF (x)		14.3	14.1	12.0
Number of shares (m)	453.74	Price/Sales (x)		6.02
BV/share (Next Qtr., US$)	49.6	P/BVPS (x)		6.4
Net debt (Next Qtr., US$ m)	36,643.7	Dividend (current, US$)		5.5
Dividend yield (%)	-			

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$290.0

Quarterly EPS	Q1	Q2	Q3	Q4
2019A	5.55	5.21	5.16	5.39
2020E	5.25	5.14	5.20	5.90
2021E	5.80	5.65	6.30	6.40

Broadcom Ltd (AVGO)

Price (17 Jul 2020): **US$312.71**

Target Price: **400.00**

Analyst: **John Pitzer**

Rating: **Outperform**

Income Statement	10/19A	10/20E	10/21E
Revenue (US$ m)	**22,597.0**	**23,595.0**	**25,050.0**
EBITDA	**12,498.0**	**13,198.8**	**14,363.5**
Operating profit	**11,929.0**	**12,611.3**	**13,796.5**
Recurring profit	**10,620.0**	**11,035.3**	**12,288.5**
Cash Flow	**10/19A**	**10/20E**	**10/21E**
Cash flow from operations	**9,697**	**10,042**	**11,696**
CAPEX	(432)	(496)	(501)
Free cash flow to the firm	**9,265**	**9,546**	**11,195**
Cash flow from investments	**(15,441)**	**(11,203)**	**(501)**
Net share issue(/repurchase)	3,741	128	0
Dividends paid	(4)	(6)	(5)
Issuance (retirement) of debt	13,581	10,603	0
Other	(10,957)	(6,907)	(6,985)
Cash flow from financing activities	6,361	3,818	(6,990)
Effect of exchange rates	-	-	-
Changes in Net Cash/Debt	**4,805**	**(8,554)**	**4,205**
Net debt at end	27,743	36,297	32,092
Balance Sheet ($US)	**10/19A**	**10/20E**	**10/21E**
Assets			
Other current assets	729	851	851
Total current assets	**9,917**	**13,038**	**17,162**
Total assets	**67,493**	**76,591**	**73,584**
Liabilities			
Short-term debt	0	0	1
Total current liabilities	6,899	6,252	6,395
Long-term debt	30,011	43,044	43,044
Total liabilities	42,523	55,229	55,372
Shareholder equity	24,970	21,362	18,212
Total liabilities and equity	**67,493**	**76,591**	**73,584**
Net debt	27,743	36,297	32,092
Per share	**10/19A**	**10/20E**	**10/21E**
No. of shares (wtd avg)	444	452	448
CS adj. EPS	21.30	21.50	24.15
Prev. EPS (US$)	-	-	-
Dividend (US$)	4.24	5.51	4.99
Free cash flow per share	20.88	21.13	24.99
Earnings	**10/19A**	**10/20E**	**10/21E**
Sales growth (%)	8.3	4.4	6.2
Net profit growth (%)	0.6	2.7	12.3
EPS growth (%)	2.3	0.9	12.3
EBIT margin (%)	52.8	53.4	55.1
Valuation	**10/19A**	**10/20E**	**10/21E**
EV/Sales (x)	7.51	7.55	6.95
EV/EBIT (x)	14.2	14.1	12.6
P/E (x)	14.7	14.5	12.9

Quarterly EPS	Q1	Q2	Q3	Q4
2019A	5.55	5.21	5.16	5.39
2020E	5.25	5.14	5.20	5.90
2021E	5.80	5.65	6.30	6.40

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

AVGO is a designer, developer and supplier of analog and digital semiconductor connectivity solutions. AVGO's product portfolio serves four primary end markets: Wired Infrastructure, Wireless Communications, Enterprise Storage and Industrial.

Blue/Grey Sky Scenario

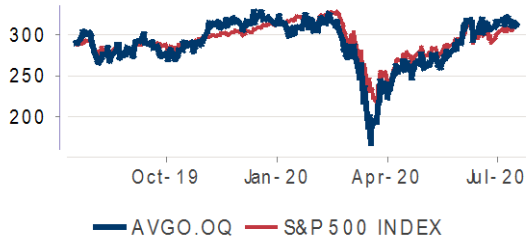
Our Blue Sky Scenario (US$) **450.00**

Our blue sky scenario assumes that AVGO continues to grow EPS faster than Rev, executes on CA synergies and continues to gain content in the iPhone—an in-line EV/FCF multiple (merited given superior returns and diversity of growth drivers) yields a US$450 stock price.

Our Grey Sky Scenario (US$) **275.00**

Our grey sky scenario assumes that the macroeconomic environment deteriorates, the CA acquisition proves challenging, and iPhone demand is worse than expected the dividend yield provides a floor at US$275.

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73
Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$290.0

CREDIT SUISSE

Dell Technologies

"Family" approach with VMware a key advantage in hybrid push; traditional on-prem more under pressure, particularly near term

IT Hardware

DELL

Target price (12M, US$)
44.00

Neutral

- **"Family" approach a key differentiator in push to hybrid cloud.** Dell EMC's core position in Enterprise hardware combined with majority stakes in VMware (virtualisation & SW-defined management) and Pivotal (modern app development & Kubernetes, now owned by VMware) represents a powerful engine for innovation and is a key strategic differentiator vs. more on-premise focused peers in an increasingly hybrid-first future. Indeed, we like Dell's longer-term positioning and have already seen increased collaboration materialise in a number of joint offerings over the past few years including VxRail (#1 in hyperconverged), the Dell Technologies Cloud and Dell Unified Workspace, in addition to revenue synergies through the ability to cross-sell the "family" of brands.
- **Well positioned as an enterprise leader; near-term environment more difficult.** Dell's core Infrastructure Solutions Group (ISG) is primarily focused on prem enterprise environments, offering a full spectrum of HW & Services across servers, storage and networking. Since its acquisition of EMC in 2016, the company maintains #1 global share in servers (ex-ODM) and external storage according to IDC, which provides it with key scale advantages in design, procurement and GTM coverage. It has also taken steps to combine portfolio particularly in storage, which we believe will help optimise R&D and S&M resources long term, despite some potential near-term disruption from combining multiple legacy platforms. Along with a deepening integration with VMware (81% owned by Dell), the leader in virtualisation, we believe this positions the company well to continue consolidating share in the years ahead. That said, pressure on IT budgets from a weaker macro and on margins from fading costs tailwinds and aggressive competition, particularly in more commoditised servers, remain key risks in the current environment.
- **Neutral on near-term caution and leverage.** We balance our favourable view of Dell's "family" approach in a hybrid-first world LT and undemanding valuation against near-term concerns as (1) PC tailwinds fade with the risk of pull-forward from 2H, compounded by waning Win 10 momentum; (2) a challenging Enterprise demand environment and a potential pause as Dell's new mid-range PowerStore takes time to ram; and (3) outsized "core" debt leaves little room for error. Further, the key debate on the stock is squarely focused on strategic optionality around Dell's 81% stake in VMware; we recognise the SOTP disconnect, but view VMW as a key piece of Dell's strategic advantage longer-term.

Price (17 Jul 20, US$)	60.37
52-week price range	60.37 - 28.87
Market cap (US$ m)	44,723.09
Enterprise value (US$ m)	78,356

Research Analysts

Matthew Cabral
415 249 7929
matthew.cabral@credit-suisse.com

Dan Knauff, CFA
415 249 7925
daniel.knauff@credit-suisse.com

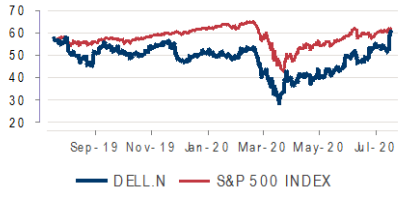
Michael Allen
415 249 7926
michael.allen@credit-suisse.com

Financial and valuation metrics

Year	1/20A	1/21E	1/22E	1/23E
EPS (Excl. ESO) (US$)	8.75	6.66	7.58	8.63
EPS (CS adj.,)	7.36	5.29	6.30	7.35
Prev. EPS (CS adj., US$)	-	-	-	-
P/E (CS adj.) (x)	8.2	11.4	9.6	8.2
P/E rel. (CS adj., %)	42.1	45.2	49.2	49.2
Revenue (US$ m)	92,501.0	88,322.8	91,262.5	94,361.6
Net Debt (US$ m)	42,754	33,633	26,942	20,181
OCFPS (US$)	12.38	12.23	12.50	12.82
P/OCF (x)	4.9	4.9	4.8	4.7
Number of shares (m)	740.82	Price/Sales (x)		0.50
BV/share (Next Qtr., US$)	4.5	P/BVPS (x)		11.3
Net debt (Next Qtr., US$ m)	42,074.7	Dividend (current, US$)		-
Dividend yield (%)	-			

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$56.8

Quarterly EPS	Q1	Q2	Q3	Q4
2020A	1.45	2.15	1.75	2.00
2021E	1.34	1.27	1.20	1.47
2022E	1.33	1.55	1.54	1.89

CREDIT SUISSE

Dell Technologies (DELL)

Analyst: **Matthew Cabral**

Price (17 Jul 2020): **US$60.37**

Target Price: **44.00**

Rating: **Neutral**

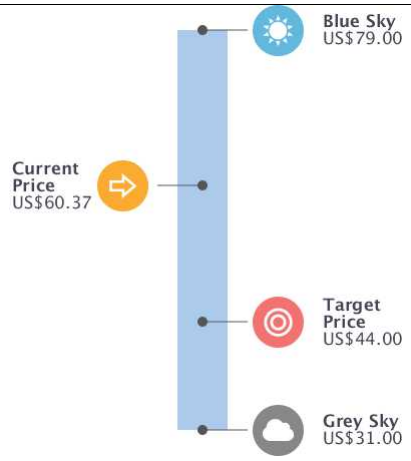
Income Statement	1/20A	1/21E	1/22E	1/23E
Revenue (US$ m)	**92,501.0**	**88,322.8**	**91,262.5**	**94,361.6**
EBITDA	**11,787.0**	**10,061.1**	**10,854.3**	**11,795.4**
Operating profit	**10,148.0**	**8,480.2**	**9,214.1**	**10,096.4**
Recurring profit	**7,328.0**	**5,541.3**	**6,684.3**	**7,756.5**
Cash Flow	**1/20A**	**1/21E**	**1/22E**	**1/23E**
Cash flow from operations	**9,291**	**9,279**	**9,567**	**9,824**
CAPEX	(2,564)	(2,154)	(2,181)	(2,243)
Free cash flow to the firm	**6,727**	**7,126**	**7,386**	**7,581**
Cash flow from investments	**(5,028)**	**(440)**	**(2,541)**	**(2,603)**
Net share issue(/repurchase)	(3,052)	(664)	(695)	(820)
Dividends paid	0	0	0	0
Issuance (retirement) of debt	(1,636)	(4,182)	(4,049)	(5,649)
Other	84	(42)	0	0
Cash flow from financing activities	(4,604)	(4,888)	(4,744)	(6,469)
Effect of exchange rates	-	-	-	-
Changes in Net Cash/Debt	**1,091**	**9,121**	**6,691**	**6,761**
Net debt at end	42,754	33,633	26,942	20,181
Balance Sheet ($US)	**1/20A**	**1/21E**	**1/22E**	**1/23E**
Assets				
Other current assets	6,906	6,938	6,651	6,634
Total current assets	**36,868**	**39,734**	**42,857**	**44,720**
Total assets	**118,861**	**116,672**	**115,470**	**113,132**
Liabilities				
Short-term debt	7,737	9,561	8,161	4,152
Total current liabilities	52,042	54,355	54,793	52,424
Long-term debt	44,319	37,660	35,051	33,451
Total liabilities	115,706	111,598	110,546	107,610
Shareholder equity	3,155	5,074	4,924	5,522
Total liabilities and equity	**118,861**	**116,672**	**115,470**	**113,132**
Net debt	42,754	33,633	26,942	20,181
Per share	**1/20A**	**1/21E**	**1/22E**	**1/23E**
No. of shares (wtd avg)	751	759	765	767
CS adj. EPS	7.36	5.29	6.30	7.35
Prev. EPS (US$)	-	-	-	-
Dividend (US$)	0.00	0.00	0.00	0.00
Free cash flow per share	8.96	9.39	9.65	9.89
Earnings	**1/20A**	**1/21E**	**1/22E**	**1/23E**
Sales growth (%)	1.3	(4.5)	3.3	3.4
Net profit growth (%)	17.5	(27.4)	20.3	16.8
EPS growth (%)	16.9	(28.1)	19.2	16.6
EBIT margin (%)	11.0	9.6	10.1	10.7
Valuation	**1/20A**	**1/21E**	**1/22E**	**1/23E**
EV/Sales (x)	0.95	0.89	0.79	0.69
EV/EBIT (x)	8.6	9.2	7.8	6.4
P/E (x)	8.2	11.4	9.6	8.2
Quarterly EPS	**Q1**	**Q2**	**Q3**	**Q4**
2020A	1.45	2.15	1.75	2.00
2021E	1.34	1.27	1.20	1.47
2022E	1.33	1.55	1.54	1.89

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Dell is a diversified IT hardware company focusing on PCs, accessories, and enterprise IT infrastructure. The company also owns majority stakes in several publicly traded enterprise-focused software firms including VMware, Pivotal and SecureWorks.

Blue/Grey Sky Scenario



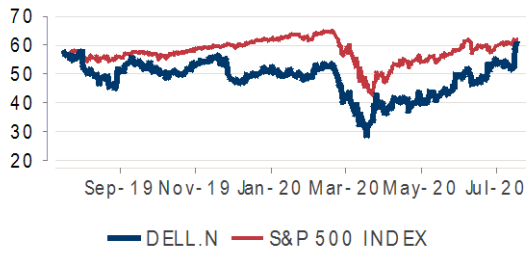
Our Blue Sky Scenario (US$) **79.00**

Our blue sky scenario of US$79 assumes a 150 bp increase in revenue growth, a 50 bp increase in gross margins, and 25 bp decrease in opex as a % of sales relative to our base case assumptions. This yields CY21E EPS of US$7.21 (17% upside to base case EPS) on which we apply an 11x multiple, to reflect a faster growth rate.

Our Grey Sky Scenario (US$) **31.00**

Our grey sky scenario of US$31 assumes a 150 bp decrease in revenue growth, 50 bp of downward pressure on gross margins, and a 25 bp increase in opex as a % of sales. This yields CY21E EPS of US$5.17 (-16% vs. our base case EPS) on which we apply a 6x multiple to reflect a slower growth rate.

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73
Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$56.8

CREDIT SUISSE

Delta Electronics

Well positioned to capture the 5G opportunity in cloud, edge, and device

2308.TW

Target price (12M, NT$)
208.00

Outperform

Electronic Components & Connectors

- **Leadership in power and cooling to stay ahead in the power/energy efficiency competition.** Silicon scaling limitation, exponential data processing, broader machine learning framework, on-device intelligence, and 5G adoption, have led to a significant design change on hardware components. How to deal with high bandwidth, low latency and massive connectivity, while meeting cost efficiency is also important, given a huge ASP increase on design change and an estimated 40% of electrical power used to cool down a data centre. We believe Delta's core competence in highly efficient power electronics (including power supply, cooling components, rack, BMS, monitoring, and backup power) should continue to help the company stay ahead in the power/energy efficiency competition.
- **A rich product offering to capture 5G opportunity.** Delta offers customer-tailored data centre solutions that are highly reliable in power distribution, control system and energy saving (with PUE less than 1.4), which contributes to 4-5% of revenue, mainly for non-China enterprise customers, but Delta is also gaining traction in HPC. Delta also offers richer product offerings including server power supply, telecom power supply, cooling, power chokes and networking, etc., to capture the 5G opportunity, with a combined revenue contribution of at least one-third of the total.
- **Mix-driven GM expansion on track.** We think Delta's mix-driven GM expansion is still on track, thanks to strong restocking in WFH and smartphones, and IA recovery. We see a fairly good chance for 2Q20 OPM to hit two-year highs, which should serve as a positive near-term catalyst. We expect its mix-driven margin uptrend to hold in 2H20, thanks to iPhone production volume QoQ growth (new SE and iPhone 11 to drive 3Q, and new 5G iPhone to drive 4Q), new game console launch, and non-China telecom orders.
- **Delta rated OUTPERFORM.** Delta is our preferred pick in the downstream component sector, given accelerating earnings momentum driven by growing revenue contribution from ASP/margin-accretive 5G business, which includes cloud, edge and device. Its earnings growth could be more powerful, if we see accelerating momentum in telecom power supply and networking businesses.

Price (17 Jul 20, NT$)	184.00
Upside/downside (%)	13.0
Mkt cap (NT$/US$ mn)	477,948 / 16,227
Enterprise value (NT$ mn)	471,101
Number of shares (mn)	2,598
Free float (%)	74.8
52-wk price range (NT$)	186-111
ADTO-6M (US$ mn)	40.2

Research Analysts

Pauline Chen
886 2 2715 6323
pauline.chen@credit-suisse.com

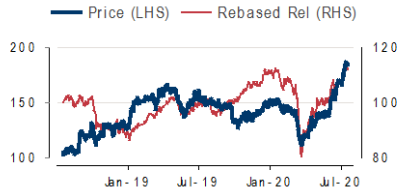
Angela Pan
886 2 27156352
angela.pan@credit-suisse.com

Financial and valuation metrics

Year	12/19A	12/20E	12/21E	12/22E
Revenue (NT$ mn)	268,131	268,335	293,242	315,154
EBITDA (NT$ mn)	33,394.2	48,101.2	53,814.6	57,477.2
EBIT (NT$ mn)	19,408.8	23,621.0	27,010.4	29,273.1
Net profit (NT$ mn)	23,117.8	19,933.1	23,107.4	24,948.0
EPS (CS adj.) (NT$)	8.9	7.67	8.9	9.6
Chg. from prev. EPS (%)	n.a.	0.0	0.0	0.0
Consensus EPS (NT$)	n.a.	7.72	9.62	11.16
EPS growth (%)	27.1	(13.8)	15.9	8.0
P/E (x)	20.7	24.0	20.7	19.2
Dividend yield (%)	2.7	2.9	3.4	3.7
EV/EBITDA (x)	14.0	9.9	8.6	8.0
P/B (x)	3.41	3.25	3.06	2.95
ROE (%)	17.1	13.9	15.2	15.7
Net debt/equity (%)	(6.4)	(1.9)	(6.9)	(9.6)

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17/07/20. On 17/07/20 the spot exchange rate was NT$29.45/US$1

Performance	1M	3M	12M
Absolute (%)	15.7	36.8	24.7
Relative (%)	10.1	21.9	11.9

CREDIT SUISSE

Delta Electronics (2308.TW / 2308 TT)

Price (17 Jul 2020): **NT$184.00** Target Price: **NT$208.00**

Analyst: **Pauline Chen**
Rating: **Outperform**

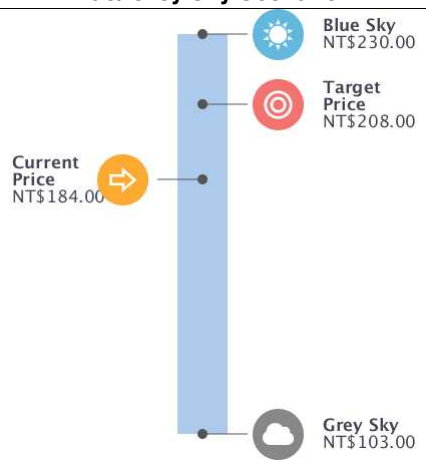
Income Statement (NT$ mn)	12/19A	12/20E	12/21E	12/22E
Sales revenue	**268,131**	**268,335**	**293,242**	**315,154**
Cost of goods sold	193,635	187,312	204,319	219,635
EBITDA	**33,394**	**48,101**	**53,815**	**57,477**
EBIT	**19,409**	**23,621**	**27,010**	**29,273**
Net interest expense/(inc.)	(149)	(303)	(360)	(527)
Recurring PBT	**29,154**	**26,437**	**30,265**	**32,684**
Profit after tax	**23,928**	**21,609**	**24,817**	**26,801**
Reported net profit	**23,118**	**19,933**	**23,107**	**24,948**
Net profit (Credit Suisse)	**23,118**	**19,933**	**23,107**	**24,948**
Balance Sheet (NT$ mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Cash & cash equivalents	46,490	38,785	48,580	54,189
Current receivables	57,035	61,863	60,870	61,079
Inventories	39,316	45,635	48,072	50,172
Other current assets	4,717	4,717	4,717	4,717
Current assets	**147,558**	**151,000**	**162,239**	**170,156**
Property, plant & equip.	57,851	68,402	67,889	67,542
Investments	5,248	5,904	6,548	6,523
Intangibles	26,359	27,241	27,262	27,202
Other non-current assets	74,022	67,400	67,379	67,439
Total assets	**311,037**	**319,946**	**331,317**	**338,862**
Current liabilities	**85,726**	**87,690**	**89,906**	**91,815**
Total liabilities	**136,683**	**138,646**	**140,863**	**142,772**
Total debt	35,390	35,390	35,390	35,390
Shareholders' equity	**140,157**	**147,102**	**156,256**	**161,892**
Minority interests	34,198	34,198	34,198	34,198
Total liabilities & equity	**311,037**	**319,946**	**331,317**	**338,862**
Cash Flow (NT$ mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
EBIT	**19,409**	**23,621**	**27,010**	**29,273**
Net interest	149	303	360	527
Tax paid	(5,227)	(4,829)	(5,448)	(5,883)
Working capital	(2,259)	(9,183)	772	(399)
Other cash & non-cash items	23,014	25,412	28,094	29,355
Operating cash flow	**35,086**	**35,324**	**50,790**	**52,873**
Capex	(28,075)	(17,000)	(14,000)	(15,566)
Free cash flow to the firm	**7,011**	**18,324**	**36,790**	**37,307**
Investing cash flow	**(73,076)**	**(30,041)**	**(27,041)**	**(27,952)**
Equity raised	11,776	(12,988)	(13,953)	(19,312)
Dividends paid	0	0	0	0
Financing cash flow	**22,096**	**(12,988)**	**(13,953)**	**(19,312)**
Total cash flow	**(15,895)**	**(7,705)**	**9,795**	**5,609**
Adjustments	0	0	0	0
Net change in cash	**(15,895)**	**(7,705)**	**9,795**	**5,609**
Per share	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Shares (wtd avg.) (mn)	2,598	2,598	2,598	2,598
EPS (Credit Suisse) (NT$)	**8.90**	**7.67**	**8.90**	**9.60**
DPS (NT$)	5.00	5.37	6.23	6.72
Operating CFPS (NT$)	13.51	13.60	19.55	20.36
Earnings	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Growth (%)				
Sales revenue	13.1	0.1	9.3	7.5
EBIT	6.8	21.7	14.3	8.4
EPS	27.1	(13.8)	15.9	8.0
Margins (%)				
EBITDA	12.5	17.9	18.4	18.2
EBIT	7.2	8.8	9.2	9.3
Valuation (x)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
P/E	20.7	24.0	20.7	19.2
P/B	3.41	3.25	3.06	2.95
Dividend yield (%)	2.7	2.9	3.4	3.7
EV/sales	1.7	1.8	1.6	1.5
EV/EBITDA	14.0	9.9	8.6	8.0
EV/EBIT	24.1	20.1	17.2	15.7
ROE analysis (%)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
ROE	17.1	13.9	15.2	15.7
ROIC	11.7	11.3	12.5	13.5
Credit ratios	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Net debt/equity (%)	(6.4)	(1.9)	(6.9)	(9.6)
Net debt/EBITDA (x)	(0.33)	(0.07)	(0.25)	(0.33)

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Delta Electronics, Inc. is a Taiwan-based supplier of power management products; information & communication components; video products & electromechanical products, including inverters.

Blue/Grey Sky Scenario



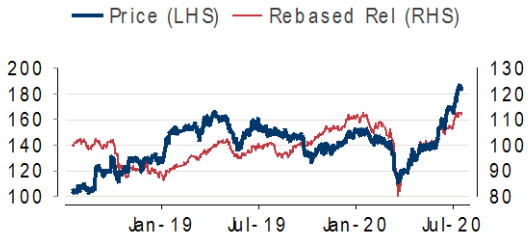
Our Blue Sky Scenario (NT$) **230.00**

Our blue sky scenario of NT$230.0 is based on +2 standard deviation multiple of FY20E earnings.

Our Grey Sky Scenario (NT$) **103.00**

Our grey sky scenario of NT$103 is based on its lowest share price YTD.

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17-Jul-2020
On 17-Jul-2020 the spot exchange rate was NT$29.45/US$1

CREDIT SUISSE

Digital Realty Trust, Inc.

Leading hyperscale data centre aligned with cloud growth

Data Centre REITs

DLR

Target price (12M, US$)
164.00

Outperform

- DLR Indexed to cloud growth. DLR is the leading US hyperscale data centre provider, providing it with the most direct indexation to hyperscale cloud growth. Cloud service providers are projected to grow at a +12.0% CAGR through 2024E, based on the latest Omdia data. As DLR's top customers (mainly hyperscale) have expanded their businesses, they have also meaningfully grown their footprints in DLR's data centres. DLR's top customers have grown from a base rent of ~US$679 mn (43% of rental revenues) in 2016 to ~US$1.2 bn in annualised base rent (53% of rental revenues) in 1Q 2020.
- InterXion acquisition enhances DLR's position significantly. We are broadly constructive on DLR's acquisition of InterXion for three reasons: InterXion is indexed to retail colocation in a high-growth region that is projected to grow significantly as enterprises migrate to hybrid cloud models; InterXion brings highly connected and rich communities of interest into DLR's portfolio, and should spur high-margin interconnection growth; InterXion's European focus significantly diversifies DLR's US-focused operations. Following the deal, DLR is set to triple its European footprint, with the majority of InterXion capacity in mainland Europe, strengthening DLR's opportunity to work with enterprises across multiple locations on the continent. Finally, while the deal is not accretive NT, there are many medium/LT strategic benefits from the combination of the businesses.
- Thesis: Three factors for our Outperform rating: (1) data centre demand remains elevated and DLR is in a solid position to capture the global digital infrastructure demand trends seen through its top 20 customer list, leasing backlog, and overall industry demand dynamics; (2) by 4Q20E, we project improved lease renewal spreads as older lease vintages are processed, and (3) DLR's ROIC yields are forecasted to inflect higher, largely driven by the InterXion acquisition, headed to ~12% vs its historical average consistently below that level. InterXion is indexed to retail colocation in a high-growth region that is projected to grow significantly as enterprises migrate to hybrid cloud models; it brings highly connected and rich communities into DLR's portfolio, and should spur high-margin interconnection growth; its European focus significantly diversifies DLR's US-focused operations.
- Valuation: Outperform, US$164 target price. We value DLR at US$164 per share (implying a 12% upside potential), computed with a 25.5x multiple on our FY21 AFFOS estimate of US$6.42. Key risks include technological disruption, market competition, forex volatility, and REIT qualification loss.

Price (17 Jul 20, US$)	143.75
52-week price range	154.23 - 107.90
Market cap (US$ m)	38,570.00
Enterprise value (US$ m)	39,446

Research Analysts

Sami Badri
212 538 1727
ahmedsami.badri@credit-suisse.com

George Engroff
212 325 2289
george.engroff@credit-suisse.com

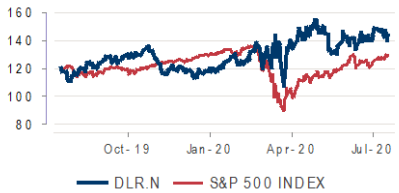
Lauren Lucas
212 325 4310
lauren.lucas@credit-suisse.com

Financial and valuation metrics

Year			12/19A	12/20E	12/21E
Normalized FFO/Share (US$)			6.65	5.33	6.39
Adjusted FFO/Share (US$)			5.93	5.62	6.42
Credit Suisse diluted EPS (US$)			2.35	1.71	2.25
P/AFFO(US$ m)			24.3	25.6	22.4
Dividend Yield (US$ m)			3.0	3.1	3.6
AFFO Payout Ratio %			72.9	79.7	81.5
EBITDA Margin %			56.6	53.5	56.2
Revenue (US$ m)			3,209	3,812	4,430
Current Dividend yield (%)	3.1	Debt-to-Capitalization			2.6
Price/AFFO	25.6	Net Debt-to-EBITDA			-
EV/EBITDA	16.1	Enterprise Value ($m)			32,925

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$117.73

Adjusted FFO	Q1	Q2	Q3	Q4
2019A	1.53	1.50	1.48	1.41
2020E	1.44	1.35	1.35	1.48
2021E	1.64	1.55	1.59	1.63

Digital Realty Trust, Inc. (DLR)

Price (17 Jul 2020): **US$143.75** Target Price: **164.00**

Analyst: **Sami Badri**
Rating: **Outperform**

Per share	12/19A	12/20E	12/21E
Equiv. FPO (period Avg.) (mn)	210	263	282
Adjusted FFO/Share (US$)	**5.9**	**5.6**	**6.4**
DPS (US$)	4.3	4.5	5.2
BV per unit (US$)	40.3	58.5	52.3
Income Statement	**12/19A**	**12/20E**	**12/21E**
Revenue (US$)	3,209	3,812	4,430
Property operating expenses	160	183	212
Real estate taxes	-	-	-
Net operating income (US$)	**3,050**	**3,629**	**4,219**
Interest and investment income	-	-	-
Other income	-	-	-
Asset management fees (exp. item)	-	-	-
Other expenses	2,455	2,968	3,293
Interest expense/finance costs	419	368	418
Total non-property expenses	2,455	2,968	3,293
Share of associates/JVs' equity	8	(49)	40
Net income before tax	**611**	**571**	**771**
Income tax (expense)	12	19	29
Distributable income to unitholders	603	620	731
Net income (US$)	**1,453**	**1,607**	**1,864**
Cash Flow	**12/19A**	**12/20E**	**12/21E**
Net interest paid	(419)	(368)	(418)
Other cash & non-cash items	1,544	1,629	2,100
Cash flow from operatiions	1,514	1,659	2,150
Other investment/(outflows)	(351)	(2,540)	(2,477)
Cash flow from investment	(275)	(2,227)	(2,477)
Dividends paid	(997)	(1,412)	(1,328)
Equity raised	-	-	-
Net borrowings	-	-	-
Other financing cash flows	(275)	1,812	1,570
Financial cash flow	(1,272)	400	242
Net cash flow	(33)	(169)	(85)
Balance Sheet	**12/19A**	**12/20E**	**12/21E**
Assets			
Cash and equivalents	90	-	-
Accounts receivable	306	425	459
Total current assets	874	927	986
Total fixed assets	1,287	1,064	1,064
Investment properties	14,231	19,105	20,132
Other investments	-	-	-
Other non-current assets	17,544	24,315	25,270
Total assets	**23,068**	**33,772**	**34,787**
Accounts payable	1,008	1,781	1,891
Short-term debt	810	771	771
Total current liabilities	**2,053**	**2,553**	**2,662**
Long-term debt	105	104	104
Other non-current liabilities	1,242	1,781	1,891
Total non-current liabilities	10,366	14,418	15,967
Total liabilities	**12,419**	**16,970**	**18,629**
Unit funds	8,445	15,368	14,724
Reserves	0	0	0
Shareholders' equity	10,650	16,802	16,157
Total capital employed	21,016	31,219	32,124
Earnings	**12/19A**	**12/20E**	**12/21E**
EBITDA growth (%)	2.7	12.3	22.0
EBITDA Margin (%)	56.6	53.5	56.2
Valuation	**12/19A**	**12/20E**	**12/21E**
EV/Sales (x)	-	-	-
EV/EBITDA (x)	21.7	19.3	15.8
EV/EBIT (x)	66.3	59.6	42.6
P/E (x)	61.1	83.9	63.8
Dividend yield (%)	3.0	3.1	3.6
P/B (x)	3.6	2.5	2.7
Gearing	**12/19A**	**12/20E**	**12/21E**
Net Debt to EBITDA (X)	0.5	0.4	0.4
Debt/Asset (%)	4.0	2.6	2.5

Adjusted FFO	Q1	Q2	Q3	Q4
2019A	1.53	1.50	1.48	1.41
2020E	1.44	1.35	1.35	1.48
2021E	1.64	1.55	1.59	1.63

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Digital Realty is a global multi-tenant colocation provider that is structured as a Real Estate Investment Trust with global operations.

Blue/Grey Sky Scenario

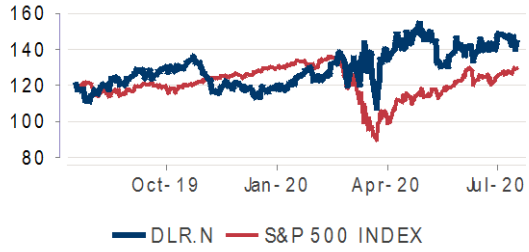
Our Blue Sky Scenario (US$) **193.00**

Our blue sky valuation of US$193 is based on our 2021 AFFO per share estimate of US$6.42 multiplied by a 30.0x P/AFFO multiple.

Our Grey Sky Scenario (US$) **96.00**

Our grey sky valuation of US$96 is based on our 2021 AFFO per share estimate of US$6.42 multiplied by a 15.0x P/AFFO multiple.

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73
Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$117.73

CREDIT SUISSE

Equinix, Inc.

On-ramps create mutually beneficial relationship between EQIX and cloud providers

EQIX

Target price (12M, US$)
704.00

Outperform

Data Centre REITs

- **Cloud and SaaS on-ramps a driving force behind the EQIX ecosystem value proposition.** EQIX is the market interconnection leader, which is recurring and high margin long-term. It is the global and most distributed data centre REIT with a world class brand, a leader in almost every market it operates in and is positioned to benefit from 5G spending and interconnection optimisation. Cloud and SaaS on-ramps should accelerate the interconnection business through 2020. Cloud on-ramps increased 35% YoY in 2019 and have seen robust growth again in 2020. More recently, similar to the cloud and software defined networking providers, software-as-a-service companies are borrowing the on-ramp playbook. They are deploying points of presence across interconnection dense data centres (such as EQIX), enhancing enterprise application connectivity. Furthermore, customers/enterprises are seeking these on-ramp/point of presence ecosystems. Most notable points of presence/on-ramp deployments come from Microsoft Azure, Cisco, Salesforce, ServiceNow, F5, and others—all deploying points of presence to win enterprise business. All in, after years of debate it is clear that cloud providers need data centre operators to win and generate more enterprise business.
- **Thesis.** We believe EQIX is best positioned as a global IX leader given its expanding business moat (mainly through scale, channel, and services reach) and global distribution. Given EQIX's positioning, it has the strongest ecosystem of any MTDC, in our view, which creates a virtuous circle of enterprise demand. 2020 catalysts will include the ramp up of SaaS company/customer on-ramps, which we view should accelerate IX growth across EQIX's vast portfolio; EQIX's Hyperscale Infrastructure team, which ramped throughout 2019; and a lower average interest expense via newly issued investment grade debt, which will support higher AFFOS growth long-term.
- **Valuation: Outperform, target price of US$704.** Our target price of US$704 is based on 25x our FY21E AFFOS of US$25.74 per share and a DCF valuation assuming a terminal growth of 2.25% and WACC of 5.3%. Key investment risks include technological disruption, competition, rising interest rates, and REIT qualification loss.

Price (17 Jul 20, US$)	724.23
52-week price range	728.69 - 486.58
Market cap (US$ m)	64,104.90
Enterprise value (US$ m)	62,629

Research Analysts

Sami Badri
212 538 1727
ahmedsami.badri@credit-suisse.com

George Engroff
212 325 2289
george.engroff@credit-suisse.com

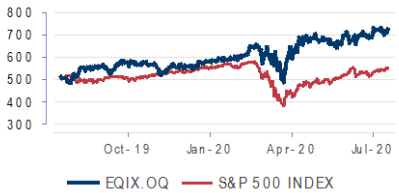
Lauren Lucas
212 325 4310
lauren.lucas@credit-suisse.com

Financial and valuation metrics

Year		12/19A	12/20E	12/21E
Normalized FFO/Share (US$)		15.53	16.06	18.13
Adjusted FFO/Share (US$)		22.85	24.06	25.74
Credit Suisse diluted EPS (US$)		22.85	24.06	25.74
P/AFFO(US$ m)		31.7	30.1	28.1
Dividend Yield (US$ m)		1.4	1.5	1.6
AFFO Payout Ratio %		43.1	44.2	45.4
EBITDA Margin %		48.3	47.7	48.4
Revenue (US$ m)		5,562	5,903	6,510
Current Dividend yield (%)	1.4	Debt-to-Capitalization		-
Price/AFFO	30.1	Net Debt-to-EBITDA		-0.3
EV/EBITDA	19.8	Enterprise Value ($m)		55,846

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$506.61

Adjusted FFO	Q1	Q2	Q3	Q4
2019A	5.95	5.87	5.52	5.51
2020E	6.21	6.14	6.33	5.39
2021E	6.79	6.73	6.59	5.64

CREDIT SUISSE

Equinix, Inc. (EQIX)

Price (17 Jul 2020): **US$724.23**

Target Price: **704.00**

Analyst: **Sami Badri**

Rating: **Outperform**

Per share	12/19A	12/20E	12/21E
Equiv. FPO (period Avg.) (mn)	85	87	88
Adjusted FFO/Share (US$)	**22.8**	**24.1**	**25.7**
DPS (US$)	9.8	10.6	11.7
BV per unit (US$)	148.4	0.0	0.0
Income Statement	**12/19A**	**12/20E**	**12/21E**
Revenue (US$)	5,562	5,903	6,510
Property operating expenses	1,851	1,971	2,175
Real estate taxes	-	-	-
Net operating income (US$)	**3,711**	**3,931**	**4,335**
Interest and investment income	-	-	-
Other income	4	-	-
Asset management fees (exp. item)	-	-	-
Other expenses	2,545	2,857	3,056
Interest expense/finance costs	452	415	469
Total non-property expenses	2,545	2,857	3,056
Share of associates/JVs' equity	-	-	-
Net income before tax	**693**	**648**	**810**
Income tax (expense)	185	135	162
Distributable income to unitholders	693	648	810
Net income (US$)	**507**	**513**	**648**
Cash Flow	**12/19A**	**12/20E**	**12/21E**
Net interest paid	(452)	(415)	(469)
Other cash & non-cash items	2,086	2,258	2,552
Cash flow from operatiions	1,996	2,286	2,497
Other investment/(outflows)	(1,945)	(3,081)	(2,971)
Cash flow from investment	(1,945)	(3,081)	(2,971)
Dividends paid	(836)	(925)	(1,033)
Equity raised	-	-	-
Net borrowings	-	-	-
Other financing cash flows	2,038	1,622	2,610
Financial cash flow	1,202	697	1,577
Net cash flow	1,262	(124)	1,104
Balance Sheet	**12/19A**	**12/20E**	**12/21E**
Assets			
Cash and equivalents	1,870	1,769	2,873
Accounts receivable	689	732	814
Total current assets	2,873	2,963	4,149
Total fixed assets	12,153	12,843	13,705
Investment properties	-	-	-
Other investments	0	0	0
Other non-current assets	2,056	2,058	2,058
Total assets	**23,966**	**24,899**	**26,947**
Accounts payable	761	841	910
Short-term debt	0	1,750	4,300
Total current liabilities	**2,158**	**3,712**	**6,331**
Long-term debt	0	0	0
Other non-current liabilities	2,158	1,962	2,031
Total non-current liabilities	12,967	11,077	10,887
Total liabilities	**15,125**	**14,789**	**17,218**
Unit funds	-	-	-
Reserves	12,552	0	0
Shareholders' equity	8,840	10,110	9,729
Total capital employed	21,808	21,188	20,616
Earnings	**12/19A**	**12/20E**	**12/21E**
EBITDA growth (%)	11.4	4.7	11.9
EBITDA Margin (%)	48.3	47.7	48.4
Valuation	**12/19A**	**12/20E**	**12/21E**
EV/Sales (x)	-	-	-
EV/EBITDA (x)	23.2	22.8	20.8
EV/EBIT (x)	53.2	59.7	51.3
P/E (x)	31.7	30.1	28.1
Dividend yield (%)	1.4	1.5	1.6
P/B (x)	4.9		
Gearing	**12/19A**	**12/20E**	**12/21E**
Net Debt to EBITDA (X)	Net Cash	Net Cash	0.5
Debt/Asset (%)	0.0	7.0	16.0

Adjusted FFO	Q1	Q2	Q3	Q4
2019A	5.95	5.87	5.52	5.51
2020E	6.21	6.14	6.33	5.39
2021E	6.79	6.73	6.59	5.64

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Equinix is a global multi-tenant colocation provider that is structured as a Real Estate Investment Trust. Equinix maintains operations in North America, Europe, and Asia, and offers a range of products, services, and solutions.

Blue/Grey Sky Scenario

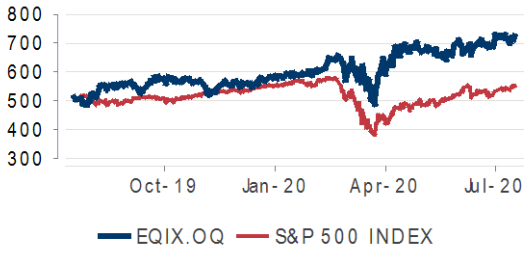
Our Blue Sky Scenario (US$) **847.00**

Our blue sky scenario of US$847 is based on 25.5x our FY21E AFFOS of US$25.74 per share and a DCF valuation assuming a terminal growth of 3.0% and WACC of 5.3%.

Our Grey Sky Scenario (US$) **472.00**

Our grey sky scenario of US$472 is based on 16x our FY21E AFFOS of US$25.74 per share and a DCF valuation assuming a terminal growth of 1.25% and WACC of 5.3%.

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73
Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$506.61

CREDIT SUISSE

Foxconn Industrial Internet

A share gainer in the cloud market

601138.SS

Target price (12M, Rmb)
17.00

Outperform

Electronic Equipment & Instruments

- **A share gainer in the cloud market.** Silicon scaling limitation, exponential data processing, broader machine learning framework, on-device intelligence and 5G adoption, have led to a significant design change on hardware components. How to deal with high bandwidth, low latency and massive connectivity, while meeting cost efficiency is also important, given a huge ASP increase. While being a late comer in the cloud market, FII has been making decent progress by expanding its customer base from Dell/HPE/Oracle/NVIDIA/NetApp/EMC, and has been gaining share in Microsoft, AWS, Alibaba, iQIYI, ByteDance, Tencent, etc. In 2019, cloud service equipment solution (CSES) accounted for 40% of FII's revenue and 19% of gross profits.
- **Growing CSP mix to drive cloud sales growth and margin expansion.** We expect FII's CSES to remain the key revenue growth driver in 2020-21E, thanks to strong underlying market growth and its share gains in CSP (cloud service provider). While FII's CSES generates lower-than-peers GM (at 4% in 2019, vs. Wiwynn's 6.9%), due to its higher exposure to enterprise customers, we expect its continued market share gains in CSP (especially Microsoft) to drive margin improvement in CSES in 2020-21E. FII's CSP revenue grew 48% YoY and represented 20% of its CSES sales in 2019.
- **Casing and CSP driving mix improvement in 2H20.** Besides share gains in higher-margin CSP, we expect mix improvement to also be driven by stabilising iPhone builds (from new SE and promotion on iPhone 11) and 5G iPhones launch. This should mitigate the impact from enterprise server noises in the near term.
- **FII rated OUTPERFORM.** We believe FII's market share gains in the fast growing cloud market, together with accelerating non-China 5G rollout, should keep earnings recovery on track. This should keep FII as the core profit generator of Hon Hai. Medium-term we will continue to monitor the progress on China-based suppliers' expansion to iPhone casing/assembly, which could impact FII's value proposition in its top customer.

Price (17 Jul 20, Rmb)	14.79
Upside/downside (%)	14.9
Mkt cap (Rmb/US$ mn)	293,908 / 42,040
Enterprise value (Rmb mn)	246,112
Number of shares (mn)	19,872
Free float (%)	13.8
52-wk price range (Rmb)	20.85-12.24
ADTO-6M (US$ mn)	155.0

Research Analysts

Pauline Chen
886 2 2715 6323
pauline.chen@credit-suisse.com

Kyna Wong
852 2101 6950
kyna.wong@credit-suisse.com

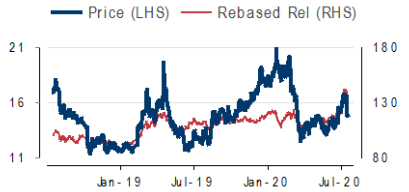
Angela Pan
886 2 27156352
angela.pan@credit-suisse.com

Financial and valuation metrics

Year	12/18A	12/19E	12/20E	12/21E
Revenue (Rmb mn)	415,378	408,698	434,163	476,095
EBITDA (Rmb mn)	24,523.5	22,382.1	21,199.2	24,324.9
EBIT (Rmb mn)	21,242.8	21,171.8	20,061.2	22,977.2
Net profit (Rmb mn)	16,902.4	18,606.2	17,973.2	20,344.5
EPS (CS adj.) (Rmb)	0.86	0.94	0.91	1.02
Chg. from prev. EPS (%)	n.a.	0.0	0.0	0.0
Consensus EPS (Rmb)	n.a.	0.94	0.93	1.08
EPS growth (%)	(4.1)	9.2	(3.4)	13.2
P/E (x)	17.2	15.8	16.3	14.4
Dividend yield (%)	0.8	1.3	1.3	1.5
EV/EBITDA (x)	10.4	11.4	11.3	9.6
P/B (x)	4.07	3.34	2.88	2.48
ROE (%)	34.0	23.3	18.9	18.5
Net debt/equity (%)	(54.8)	(43.0)	(52.2)	(51.0)

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the Shanghai Shenzhen CSI300 index which closed at 4,544.70 on 17/07/20. On 17/07/20 the spot exchange rate was Rmb6.99/US$1

Performance	1M	3M	12M
Absolute (%)	3.8	5.7	19.7
Relative (%)	(9.3)	(12.6)	(0.9)

CREDIT SUISSE

Foxconn Industrial Internet (601138.SS / 601138 CH)

Analyst: **Pauline Chen**

Price (17 Jul 2020): **Rmb14.79**

Target Price: **Rmb17.00**

Rating: **Outperform**

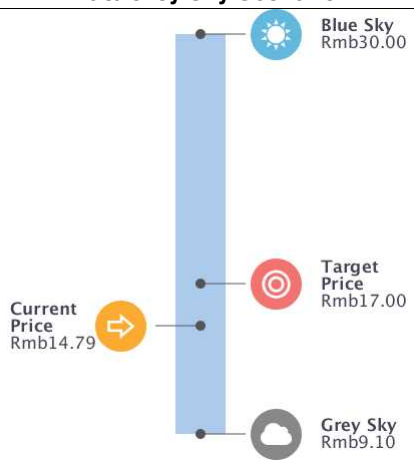
Income Statement (Rmb mn)	12/18A	12/19E	12/20E	12/21E
Sales revenue	**415,378**	**408,698**	**434,163**	**476,095**
Cost of goods sold	379,486	374,451	399,555	437,343
EBITDA	**24,523**	**22,382**	**21,199**	**24,325**
EBIT	**21,243**	**21,172**	**20,061**	**22,977**
Net interest expense/(inc.)	(306)	(771)	(1,439)	(1,635)
Recurring PBT	**20,072**	**21,132**	**20,413**	**23,373**
Profit after tax	**16,908**	**18,606**	**17,973**	**20,344**
Reported net profit	**16,902**	**18,606**	**17,973**	**20,345**
Net profit (Credit Suisse)	**16,902**	**18,606**	**17,973**	**20,345**
Balance Sheet (Rmb mn)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Cash & cash equivalents	62,293	66,901	82,466	89,422
Current receivables	87,688	85,329	89,054	98,867
Inventories	37,468	41,646	42,209	46,201
Other current assets	2,479	1,815	1,815	1,815
Current assets	**189,927**	**195,690**	**215,544**	**236,304**
Property, plant & equip.	7,596	6,644	8,622	10,390
Investments	434	550	712	873
Intangibles	746	850	735	619
Other non-current assets	1,899	1,878	1,878	1,878
Total assets	**200,603**	**205,613**	**227,490**	**250,064**
Current liabilities	**127,986**	**115,973**	**123,651**	**130,153**
Total liabilities	**128,259**	**116,264**	**123,943**	**130,445**
Total debt	22,665	28,461	28,461	28,461
Shareholders' equity	**71,528**	**87,912**	**102,111**	**118,183**
Minority interests	50	68	68	68
Total liabilities & equity	**200,603**	**205,613**	**227,490**	**250,064**
Cash Flow (Rmb mn)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
EBIT	**21,243**	**21,172**	**20,061**	**22,977**
Net interest	0	0	0	0
Tax paid	0	0	0	0
Working capital	(16,600)	(5,114)	3,523	(7,801)
Other cash & non-cash items	17,363	(9,619)	(1,112)	(1,447)
Operating cash flow	**22,006**	**6,439**	**22,472**	**13,730**
Capex	(2,685)	(2,730)	(3,000)	(3,000)
Free cash flow to the firm	**19,321**	**3,709**	**19,472**	**10,730**
Investing cash flow	**(1,368)**	**(2,818)**	**(3,000)**	**(3,000)**
Equity raised	26,781	979	0	0
Dividends paid	(698)	(3,368)	(3,907)	(3,774)
Financing cash flow	**24,885**	**2,720**	**(3,907)**	**(3,774)**
Total cash flow	**45,522**	**6,342**	**15,565**	**6,956**
Adjustments	426	97	0	0
Net change in cash	**45,948**	**6,438**	**15,565**	**6,956**
Per share	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Shares (wtd avg.) (mn)	19,695	19,855	19,855	19,855
EPS (Credit Suisse) (Rmb)	**0.86**	**0.94**	**0.91**	**1.02**
DPS (Rmb)	0.12	0.20	0.19	0.22
Operating CFPS (Rmb)	1.12	0.32	1.13	0.69
Earnings	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Growth (%)				
Sales revenue	17.2	(1.6)	6.2	9.7
EBIT	(4.1)	(0.3)	(5.2)	14.5
EPS	(4.1)	9.2	(3.4)	13.2
Margins (%)				
EBITDA	5.9	5.5	4.9	5.1
EBIT	5.1	5.2	4.6	4.8
Valuation (x)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
P/E	17.2	15.8	16.3	14.4
P/B	4.07	3.34	2.88	2.48
Dividend yield (%)	0.8	1.3	1.3	1.5
EV/sales	0.6	0.6	0.6	0.5
EV/EBITDA	10.4	11.4	11.3	9.6
EV/EBIT	12.0	12.1	12.0	10.1
ROE analysis (%)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
ROE	34.0	23.3	18.9	18.5
ROIC	68.3	44.6	35.2	37.0
Credit ratios	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Net debt/equity (%)	(54.8)	(43.0)	(52.2)	(51.0)
Net debt/EBITDA (x)	(1.62)	(1.72)	(2.55)	(2.51)

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

FII primarily engages in the design and manufacturing of communication network equipment, mechanical parts (mainly casing), cloud service equipment, precision tooling, and industrial robots.

Blue/Grey Sky Scenario



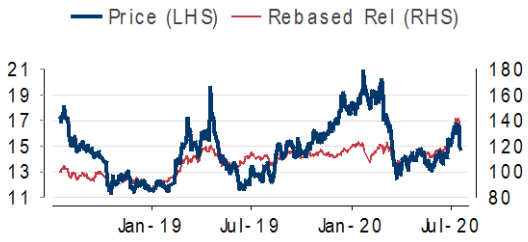
Our Blue Sky Scenario (Rmb) **30.00**

Our blue sky scenario valuation of Rmb30.0 is based on 24x 2020E EPS, close to the component P/E average of 27x. The 24x multiple is derived from sum-of-the-parts of components and assembly P/E, applying the weighting with FII's gross profit mix.

Our Grey Sky Scenario (Rmb) **9.10**

Our grey sky valuation scenario of Rmb9,4 is based on 10x 2020E EPS, benchmarking the average NTM P/E of pure assemblers.

Share price performance



The price relative chart measures performance against the Shanghai Shenzhen CSI300 index which closed at 4,544.70 on 17-Jul-2020

On 17-Jul-2020 the spot exchange rate was Rmb6.99/US$1

CREDIT SUISSE

GDS Holdings Limited

Leading China datacentre operator

GDS

Target price (12M, US$)
90.00

Outperform[V]

Integrated Telecommunication Services

- **GDS is the leading independent datacentre provider in China**, focused on provision of high-powered data centres to hyperscalers (i.e. the wholesale market). On 22 June, GDS announced that it had raised US$505 mn in new equity through a private placement to Hillhouse Capital (Not listed) and ST Telemedia Global Data Centres (Not listed) at US$65 per ADS. Hillhouse invested US$ 400mn, while STT GDC invested US$105 mn. This latest well-timed capital raising follows US$600 mn in equity capital raised in March 2019, and US$250 mn raised in an underwritten public offering on 4 December 2019.
- **Focussing on value-accretive wholesale data centre projects.** Crucially, we expect GDS to deploy this capital in value-accretive wholesale datacentre projects. We currently forecast that GDS will enjoy a 34.6% three-year revenue CAGR across FY19-22. We also forecast an increase in margins as GDS enjoys some operational gearing over centralised costs, leading us to forecast a 35.8% three-year CAGR in adjusted EBITDA.
- **Cash flow negative until FY25.** However, we acknowledge that datacentre construction is capital intensive, and so we expect GDS to remain cash flow negative until FY25 and loss-making until FY21.
- **Maintain Outperform.** To factor in both the strong structural growth and heavy capital expenditure, we use discounted cash flow (DCF) as our primary valuation methodology, deriving a target price of US$90 per ADS. GDS has enjoyed a sharp share price rally YTD, as the trends of work-from-home and increasing data use have resulted in upward revisions to consensus revenue and EBITDA forecasts, while the action of central banks has led to declining risk-free rates and borrowing rates (helpful given GDS's negative cash flow generation). We therefore maintain our OUTPERFORM rating on GDS, given strong structural growth in the 'virtual' world, as well as cheaper debt servicing in the 'real' world.

Price (17 Jul 20, US$)	81.08
Upside/downside (%)	11.0
Mkt cap (US$ mn)	12,958
Enterprise value (Rmb mn)	103,553
Number of shares (mn)	159.82
Free float (%)	22.3
52-wk price range (US$)	88.96-36.14
ADTO-6M (US$ mn)	34.5

[V] = Stock Considered Volatile (see Disclosure Appendix)

Research Analysts

Colin McCallum, CA
852 2101 6514
colin.mccallum@credit-suisse.com

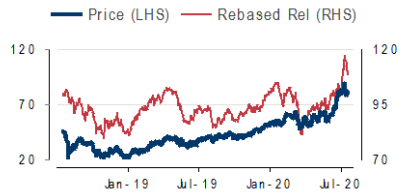
Billy Lee
852 2101 6529
billy.lee@credit-suisse.com

Financial and valuation metrics

Year	12/19A	12/20E	12/21E	12/22E
Revenue (Rmb mn)	4,122.4	5,884.0	7,962.5	10,004.6
EBITDA (Rmb mn)	1,621.8	2,498.2	3,447.0	4,275.7
EBIT (Rmb mn)	479.8	1,171.8	1,578.5	1,927.7
Net profit (Rmb mn)	(500.2)	(47.8)	80.5	182.1
EPS (CS adj.) (Rmb)	(3.63)	(0.32)	0.52	1.17
Chg. from prev. EPS (%)	n.a.	0.0	0.0	0.0
Consensus EPS (Rmb)	n.a.	(1.57)	0.42	3.09
EPS growth (%)	n.m.	n.m.	n.m.	126.2
P/E (x)	n.m.	n.m.	1,094.1	483.6
Dividend yield (%)	0.0	0.0	0.0	0.0
EV/EBITDA (x)	62.7	42.1	32.0	26.8
P/B (x)	7.37	5.93	5.9	5.83
ROE (%)	(5.9)	(0.4)	0.5	1.2
Net debt/equity (%)	97.6	97.5	131.7	160.1

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the MSCI CHINA F IDX which closed at 9,617.98 on 17/07/20. On 17/07/20 the spot exchange rate was US$1/US$1

Performance	1M	3M	12M
Absolute (%)	14.4	37.4	105.9
Relative (%)	5.8	20.4	86.9

GDS Holdings Limited (GDS.OQ / GDS US)

Price (17 Jul 2020): **US$81.08** Target Price: **US$90.00**

Analyst: **Colin McCallum**
Rating: **Outperform [V]**

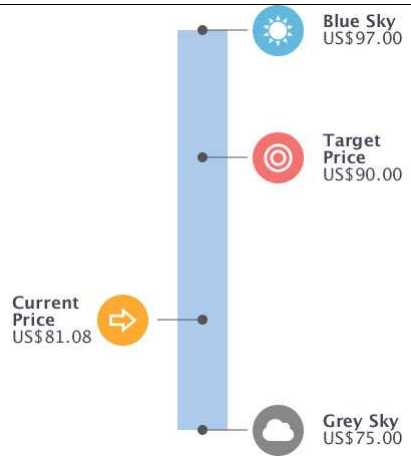
Income Statement (Rmb mn)	12/19A	12/20E	12/21E	12/22E
Sales revenue	**4,122**	**5,884**	**7,963**	**10,005**
Cost of goods sold	3,080	4,409	5,971	7,558
EBITDA	**1,622**	**2,498**	**3,447**	**4,276**
EBIT	**480**	**1,172**	**1,579**	**1,928**
Net interest expense/(inc.)	916	1,235	1,493	1,700
Recurring PBT	**(426)**	**(48)**	**101**	**243**
Profit after tax	**(442)**	**(48)**	**81**	**182**
Reported net profit	**(500)**	**(48)**	**81**	**182**
Net profit (Credit Suisse)	**(500)**	**(48)**	**81**	**182**
Balance Sheet (Rmb mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Cash & cash equivalents	5,811	6,425	5,051	2,865
Current receivables	880	751	929	1,088
Inventories	0	0	0	0
Other current assets	394	394	394	394
Current assets	**7,085**	**7,569**	**6,374**	**4,346**
Property, plant & equip.	19,185	26,188	31,265	35,825
Investments	0	0	0	0
Intangibles	2,300	2,300	2,299	2,298
Other non-current assets	2,923	2,923	2,923	2,923
Total assets	**31,493**	**38,980**	**42,860**	**45,392**
Current liabilities	**4,000**	**11,639**	**14,173**	**15,739**
Total liabilities	**20,137**	**24,137**	**27,937**	**30,287**
Total debt	16,899	20,899	24,699	27,049
Shareholders' equity	**11,356**	**14,843**	**14,923**	**15,105**
Minority interests	0	0	0	0
Total liabilities & equity	**31,493**	**38,980**	**42,860**	**45,392**
Cash Flow (Rmb mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
EBIT	**480**	**1,172**	**1,579**	**1,928**
Net interest	(916)	(1,235)	(1,493)	(1,700)
Tax paid	(16)	0	(20)	(61)
Working capital	(232)	144	(162)	(144)
Other cash & non-cash items	1,142	1,326	1,868	2,348
Operating cash flow	**459**	**1,408**	**1,771**	**2,371**
Capex	(5,131)	(8,329)	(6,945)	(6,907)
Free cash flow to the firm	**(4,672)**	**(6,921)**	**(5,174)**	**(4,537)**
Investing cash flow	**(5,131)**	**(8,329)**	**(6,945)**	**(6,907)**
Equity raised	4,928	3,535	0	0
Dividends paid	(40)	0	0	0
Financing cash flow	**8,322**	**7,535**	**3,800**	**2,350**
Total cash flow	**3,649**	**614**	**(1,374)**	**(2,187)**
Adjustments	0	0	0	0
Net change in cash	**3,649**	**614**	**(1,374)**	**(2,187)**
Per share	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Shares (wtd avg.) (mn)	138	152	155	155
EPS (Credit Suisse) (Rmb)	**(3.63)**	**(0.32)**	**0.52**	**1.17**
DPS (Rmb)	0.00	0.00	0.00	0.00
Operating CFPS (Rmb)	3.33	9.29	11.40	15.26
Earnings	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Growth (%)				
Sales revenue	47.6	42.7	35.3	25.6
EBIT	185.0	144.2	34.7	22.1
EPS	(4.4)	91.3	264.1	126.2
Margins (%)				
EBITDA	39.3	42.5	43.3	42.7
EBIT	11.6	19.9	19.8	19.3
Valuation (x)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
P/E	(156.2)	(1795.8)	1094.1	483.6
P/B	7.37	5.93	5.90	5.83
Dividend yield (%)	0.0	0.0	0.0	0.0
EV/sales	24.7	17.9	13.8	11.5
EV/EBITDA	62.7	42.1	32.0	26.8
EV/EBIT	211.9	89.7	69.8	59.5
ROE analysis (%)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
ROE	(5.9)	(0.4)	0.5	1.2
ROIC	2.6	4.5	4.0	3.9
Credit ratios	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Net debt/equity (%)	97.6	97.5	131.7	160.1
Net debt/EBITDA (x)	6.84	5.79	5.70	5.66

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

GDS Holdings limited develops and operates data centres in China

Blue/Grey Sky Scenario



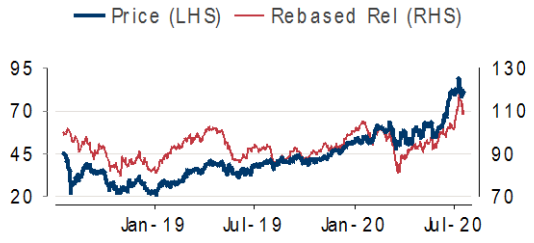
Our Blue Sky Scenario (US$) **97.00**

Our blue sky scenario assumes data centre investments have more promising growth and lower risk. The fair value of our blue sky scenario is US$97.0, implying a FY20E EV/EBITDA multiple of 48x.

Our Grey Sky Scenario (US$) **75.00**

Our grey sky scenario assumes data centre investments have less promising growth. The fair value of our grey sky scenario is US$75.0, implying a FY20E EV/EBITDA multiple of 38x.

Share price performance



The price relative chart measures performance against the MSCI CHINA F IDX which closed at 9,617.98 on 17-Jul-2020
On 17-Jul-2020 the spot exchange rate was US$1/US$1

CREDIT SUISSE

GUC

Turnkey volume uncertainty outweighs the opportunity in AI and 5G

3443.TW

Target price (12M, NT$)
250.00
Neutral[V]

Semiconductor Devices

- **IC design service provider backed by TSMC's technology leadership.** We initiate coverage on GUC with a NEUTRAL rating and a target price of NT$250 based on 28x 2021 P/E. GUC is the largest IC design service provider in Taiwan with strong technology and capacity support across mature to advanced nodes from TSMC that owns 35% of the company. We expect the company's sales to see a solid growth at 18% CAGR from 2019 to 22, with 30% GMs mainly driven by its customers' AI and 5G investments.
- **Strategy optimised for application diversification but not growth potential.** Compared with Alchip's focus on the high performance computing business, Global Unchip as TSMC's investment has a more balanced application mix, with 38% from computing (AI, HPC, BMC, SSD controller), 39% from consumer (drone, TV, surveillance camera, game console), 11% from communication (5G, networking) and 12% from others (solar). We expect GUC's diversification strategy to continue, forcing it to allocate resource in areas with less growth (consumer and solar) and limit its growth opportunity in HPC.
- **AI and 5G NRE growing but volume production still uncertain.** GUC's sales have almost doubled from 2013 to 2018, mainly driven by the surge in crypto demand but was also dragged by lower bitcoin pricing in 2019 with sales down 20% YoY. We expect the projects related to AI and 5G to be the main driver, with key ones including ZTE's 5G multiband networking chipset on 7nm, Alibaba and start-ups' AI projects, supporting growth reacceleration from 2H20 following slower QoQ trend in 1H20. Despite a healthy outlook from the NRE project pipeline, we believe the lack of production scale compared with Alchip's China CPU projects will limit the company's operating leverage.
- **Stock at the upper half already values the HPC opportunity.** We model GUC's EPS at NT$4.00/NT$8.60 for 2020/21, factoring in the company's improving growth outlook from AI and 5G investment but less operating leverage. Our target price of NT$250 is based on 27x 2021 P/E. The company's stock is at 51x/31x 2020/2021E CS estimates, at the upper half of its long-term range between 15-35x P/E. We see the premium valuation also reflects investors' high expectations for solid growth though any AI project delay in milestone or into production could drag the sentiment.

Price (17 Jul 20, NT$)	284.00
Upside/downside (%)	-12.0
Mkt cap (NT$/US$ mn)	38,059 / 1,292
Enterprise value (NT$ mn)	35,680
Number of shares (mn)	134.01
Free float (%)	73.7
52-wk price range (NT$)	324-156
ADTO-6M (US$ mn)	24.6

[V] = Stock Considered Volatile (see Disclosure Appendix)

Research Analysts

Haas Liu
886 2 2715 6365
haas.liu@credit-suisse.com

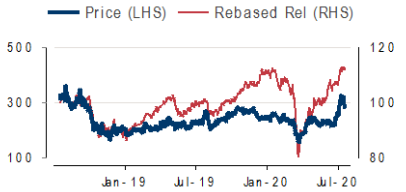
Randy Abrams, CFA
886 2 2715 6366
randy.abrams@credit-suisse.com

Financial and valuation metrics

Year	12/18A	12/19E	12/20E	12/21E
Revenue (NT$ mn)	13,459.8	10,710.1	13,038.6	15,775.0
EBITDA (NT$ mn)	1,509.6	1,295.3	1,132.1	1,912.8
EBIT (NT$ mn)	1,096.4	697.2	536.7	1,316.2
Net profit (NT$ mn)	988.2	633.5	536.6	1,152.9
EPS (CS adj.) (NT$)	7.37	4.73	4.0	8.6
Chg. from prev. EPS (%)	n.a.	0.0	0.0	0.0
Consensus EPS (NT$)	n.a.	4.37	6.26	9.14
EPS growth (%)	15.6	(35.9)	(15.3)	114.9
P/E (x)	38.5	60.1	70.9	33.0
Dividend yield (%)	1.8	1.8	1.8	1.8
EV/EBITDA (x)	22.6	27.4	31.6	18.7
P/B (x)	8.72	8.82	8.7	7.43
ROE (%)	23.5	14.6	12.4	24.3
Net debt/equity (%)	(89.5)	(58.9)	(51.4)	(45.4)

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17/07/20. On 17/07/20 the spot exchange rate was NT$29.45/US$1

Performance	1M	3M	12M
Absolute (%)	28.8	16.6	27.1
Relative (%)	23.2	1.7	14.3

GUC (3443.TW / 3443 TT)

Price (17 Jul 2020): **NT$284.00** Target Price: **NT$250.00**

Analyst: **Haas Liu**

Rating: **Neutral [V]**

Income Statement (NT$ mn)	12/18A	12/19E	12/20E	12/21E
Sales revenue	**13,460**	**10,710**	**13,039**	**15,775**
Cost of goods sold	9,443	7,180	9,543	11,040
EBITDA	**1,510**	**1,295**	**1,132**	**1,913**
EBIT	**1,096**	**697**	**537**	**1,316**
Net interest expense/(inc.)	(27)	(22)	(640)	(640)
Recurring PBT	**1,135**	**783**	**661**	**1,423**
Profit after tax	**988**	**633**	**537**	**1,153**
Reported net profit	**988**	**633**	**537**	**1,153**
Net profit (Credit Suisse)	**988**	**633**	**537**	**1,153**
Balance Sheet (NT$ mn)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Cash & cash equivalents	3,906	2,542	2,247	2,325
Current receivables	910	1,418	1,566	1,800
Inventories	1,332	2,103	2,253	2,552
Other current assets	480	553	610	701
Current assets	**6,629**	**6,616**	**6,677**	**7,379**
Property, plant & equip.	1,089	982	1,639	2,296
Investments	0	0	0	0
Intangibles	288	412	412	412
Other non-current assets	104	330	330	330
Total assets	**8,109**	**8,341**	**9,058**	**10,418**
Current liabilities	**3,635**	**3,638**	**4,295**	**4,903**
Total liabilities	**3,743**	**4,028**	**4,684**	**5,293**
Total debt	0	0	0	0
Shareholders' equity	**4,366**	**4,313**	**4,374**	**5,125**
Minority interests	0	0	0	0
Total liabilities & equity	**8,109**	**8,341**	**9,058**	**10,418**
Cash Flow (NT$ mn)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
EBIT	**1,096**	**697**	**537**	**1,316**
Net interest	0	0	0	0
Tax paid	(147)	(150)	(124)	(270)
Working capital	(571)	(973)	139	(271)
Other cash & non-cash items	(151)	533	881	960
Operating cash flow	**227**	**108**	**1,433**	**1,734**
Capex	(529)	(490)	(1,000)	(1,000)
Free cash flow to the firm	**(302)**	**(382)**	**433**	**734**
Investing cash flow	**(743)**	**(735)**	**(1,252)**	**(1,254)**
Equity raised	0	0	0	0
Dividends paid	(670)	(670)	(475)	(402)
Financing cash flow	**(670)**	**(727)**	**(475)**	**(402)**
Total cash flow	**(1,186)**	**(1,354)**	**(294)**	**78**
Adjustments	2	(11)	0	0
Net change in cash	**(1,184)**	**(1,365)**	**(294)**	**78**
Per share	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Shares (wtd avg.) (mn)	134	134	134	134
EPS (Credit Suisse) (NT$)	**7.37**	**4.73**	**4.00**	**8.60**
DPS (NT$)	5.00	5.00	5.00	5.00
Operating CFPS (NT$)	1.69	0.81	10.69	12.94
Earnings	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Growth (%)				
Sales revenue	10.7	(20.4)	21.7	21.0
EBIT	17.8	(36.4)	(23.0)	145.2
EPS	15.6	(35.9)	(15.3)	114.9
Margins (%)				
EBITDA	11.2	12.1	8.7	12.1
EBIT	8.1	6.5	4.1	8.3
Valuation (x)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
P/E	38.5	60.1	70.9	33.0
P/B	8.72	8.82	8.70	7.43
Dividend yield (%)	1.8	1.8	1.8	1.8
EV/sales	2.5	3.3	2.7	2.3
EV/EBITDA	22.6	27.4	31.6	18.7
EV/EBIT	31.2	50.9	66.7	27.1
ROE analysis (%)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
ROE	23.5	14.6	12.4	24.3
ROIC	(327.2)	50.6	22.4	43.3
Credit ratios	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Net debt/equity (%)	(89.5)	(58.9)	(51.4)	(45.4)
Net debt/EBITDA (x)	(2.59)	(1.96)	(1.99)	(1.22)

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Global Unichip (GUC) is a leading IC design service company. The company designs chipsets 100% for its customers who do not have IC design capability and the goal is to reduce entry barriers and risks for chipset design and shorten the time to market.

Blue/Grey Sky Scenario

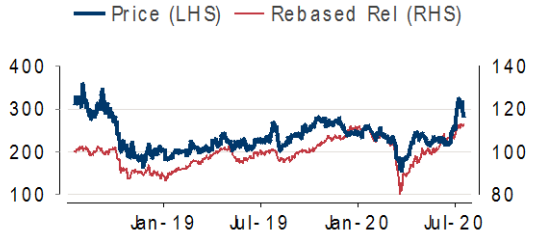
Our Blue Sky Scenario (NT$) **283.91**

Our blue sky scenario implies share price can be up to NT$283.91 on the back of faster-than-expected AI and 5G project development.

Our Grey Sky Scenario (NT$) **129.05**

Our grey sky scenario implies share price can be at NT$129.05 if its customers fail to deliver on AI or 5G networking projects.

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17-Jul-2020

On 17-Jul-2020 the spot exchange rate was NT$29.45/US$1

CREDIT SUISSE

Hewlett Packard Enterprise

Enterprise end-markets facing pressure from weak macro and increased cloud adoption

IT Hardware

HPE

Target price (12M, US$)
8.50

Underperform

- **Enterprise focused with outsized exposure to compute.** HPE is primarily focused on on-prem datacentre HW, including servers, storage, and networking and associated operational and financial services. The company derives >50% of revenue from its server business, where it holds the #2 share (ex-ODM) globally behind Dell. This business has faced persistent revenue pressure from ODM share gains, mainly in the public cloud market which HPE exited starting in CY17 due to low profitability; accelerating cloud adoption post-COVID-19 likely adds incremental pressure to traditional on-prem demand ahead. In response to the changing landscape, HPE has focused on shifting its mix toward higher value pockets of the market such as HPC, Composable, and Hyperconverged (incl. through M&A); however, it has been unable to offset the ongoing declines in core Compute, with knock-on effects to margin-rich Services. External storage, ~20% of revenue, has faced similar headwinds from soft enterprise demand, albeit to a lesser extent, with a focus on greater infusion of SW across its offerings to drive differentiation. HPE's Intelligent Edge networking business remains a bright spot in the portfolio, leveraging its Aruba Central platform to create a unified network offering, and bolstered by its announced acquisition of SD-WAN vendor Silver Peak. Amid the WFH push and following a significant organic investment, recent momentum has been encouraging, but at only ~10% of revenue, Intelligent Edge is not enough of an offset for the overall HPE, in our view.
- **Pushing to as-a-Service model.** Another key component of HPE's strategy is the goal to make its entire portfolio available as-a-Service by 2022 under its consumption based GreenLake model to support the rising preference for opex > capex, while also offering cloud services, SW, and Fin./Op. Services backing as differentiators. GreenLake is growing rapidly at >$4 bn in TCV (vs. >$3 bn in Oct.), and in our view helps lower barriers to adoption vs. legacy models; however, it still is less timely than public cloud, and with as-a-Service ARR at only ~2% of revenue currently, it will take time to make a sizeable impact.
- **Underperform on soft Enterprise and cloud gains.** With the short-term bump from WFH/BCP behind us, we see a tough macro weighing on IT budgets through at least C2H20, along with building margin pressure as DRAM tailwinds reverse vs. a soft demand backdrop that limits pricing power. Relative to peers looking to enable a consistent hybrid cloud platform, also we're concerned that HPE is over-indexed to the traditional on-prem HW spend that will come increasingly under pressure as cloud accelerates post-COVID-19.

Price (17 Jul 20, US$)	9.67
52-week price range	17.46 - 7.83
Market cap (US$ m)	12,423.60
Enterprise value (US$ m)	25,506

Research Analysts

Matthew Cabral
415 249 7929
matthew.cabral@credit-suisse.com

Dan Knauff, CFA
415 249 7925
daniel.knauff@credit-suisse.com

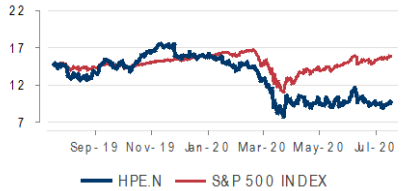
Michael Allen
415 249 7926
michael.allen@credit-suisse.com

Financial and valuation metrics

Year	10/19A	10/20E	10/21E	10/22E
EPS (Excl. ESO) (US$)	1.95	1.42	1.51	1.58
EPS (CS adj.,)	1.77	1.22	1.31	1.38
Prev. EPS (CS adj., US$)	-	-	-	-
P/E (CS adj.) (x)	5.5	8.0	7.4	7.0
P/E rel. (CS adj., %)	28.0	31.5	38.0	42.1
Revenue (US$ m)	29,135.0	25,704.1	25,126.9	25,476.2
Net Debt (US$ m)	10,067	13,083	12,925	12,901
OCFPS (US$)	2.93	1.46	2.05	2.53
P/OCF (x)	3.3	6.6	4.7	3.8
Number of shares (m)	1,284.76	Price/Sales (x)		0.48
BV/share (Next Qtr., US$)	12.5	P/BVPS (x)		0.9
Net debt (Next Qtr., US$ m)	11,584.0	Dividend (current, US$)		0.5
Dividend yield (%)	1.24			

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$14.84

Quarterly EPS	Q1	Q2	Q3	Q4
2019A	0.42	0.42	0.45	0.49
2020E	0.44	0.22	0.24	0.32
2021E	0.26	0.26	0.38	0.41

CREDIT SUISSE

Hewlett Packard Enterprise (HPE)

Price (17 Jul 2020): **US$9.67** Target Price: **8.50**

Analyst: **Matthew Cabral**
Rating: **Underperform**

Income Statement	10/19A	10/20E	10/21E	10/22E
Revenue (US$ m)	**29,135.0**	**25,704.1**	**25,126.9**	**25,476.2**
EBITDA	**5,019.0**	**4,030.1**	**4,047.8**	**4,080.9**
Operating profit	**2,751.0**	**1,924.3**	**2,073.3**	**2,135.3**
Recurring profit	**2,746.0**	**1,804.3**	**1,953.3**	**2,015.3**
Cash Flow	**10/19A**	**10/20E**	**10/21E**	**10/22E**
Cash flow from operations	**3,997**	**1,913**	**2,689**	**3,260**
CAPEX	(2,259)	(1,557)	(1,913)	(1,999)
Free cash flow to the firm	**1,738**	**356**	**776**	**1,262**
Cash flow from investments	**(3,457)**	**(993)**	**(1,793)**	**(1,879)**
Net share issue(/repurchase)	(2,249)	(355)	(200)	(800)
Dividends paid	(608)	(629)	(659)	(678)
Issuance (retirement) of debt	3,517	1,315	0	0
Other	(2,208)	(836)	120	120
Cash flow from financing activities	(1,548)	(505)	(739)	(1,358)
Effect of exchange rates	-	-	-	-
Changes in Net Cash/Debt	**(2,806)**	**(3,016)**	**157**	**24**
Net debt at end	10,067	13,083	12,925	12,901
Balance Sheet ($US)	**10/19A**	**10/20E**	**10/21E**	**10/22E**
Assets				
Other current assets	2,474	2,828	2,837	2,844
Total current assets	**15,143**	**15,504**	**15,543**	**15,647**
Total assets	**51,803**	**49,902**	**49,132**	**48,619**
Liabilities				
Short-term debt	4,425	5,162	5,162	5,162
Total current liabilities	19,159	19,100	18,509	18,348
Long-term debt	9,395	11,553	11,553	11,553
Total liabilities	34,654	36,953	36,293	36,014
Shareholder equity	17,098	12,914	12,803	12,569
Total liabilities and equity	**51,803**	**49,902**	**49,132**	**48,619**
Net debt	10,067	13,083	12,925	12,901
Per share	**10/19A**	**10/20E**	**10/21E**	**10/22E**
No. of shares (wtd avg)	1,363	1,306	1,315	1,287
CS adj. EPS	1.77	1.22	1.31	1.38
Prev. EPS (US$)	-	-	-	-
Dividend (US$)	0.46	0.48	0.50	0.53
Free cash flow per share	1.28	0.27	0.59	0.98
Earnings	**10/19A**	**10/20E**	**10/21E**	**10/22E**
Sales growth (%)	(5.6)	(11.8)	(2.2)	1.4
Net profit growth (%)	5.4	(34.3)	8.2	3.2
EPS growth (%)	19.7	(31.4)	7.5	5.4
EBIT margin (%)	9.4	7.5	8.3	8.4
Valuation	**10/19A**	**10/20E**	**10/21E**	**10/22E**
EV/Sales (x)	0.77	0.99	1.01	0.99
EV/EBIT (x)	8.2	13.3	12.2	11.9
P/E (x)	5.5	8.0	7.4	7.0
Quarterly EPS	**Q1**	**Q2**	**Q3**	**Q4**
2019A	0.42	0.42	0.45	0.49
2020E	0.44	0.22	0.24	0.32
2021E	0.26	0.26	0.38	0.41

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

HPE designs and sells enterprise hardware including servers, storage, and networking equipment, along with associated services. The company's products are distributed through a variety of channels such as direct to customers, distributors and resellers.

Blue/Grey Sky Scenario

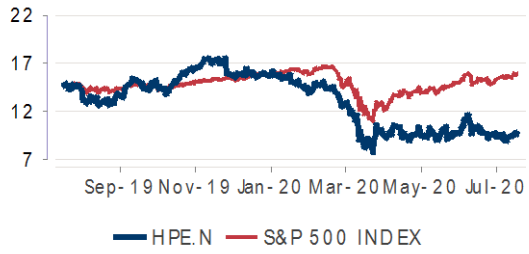
Our Blue Sky Scenario (US$) **14.00**

Our blue sky scenario assumes a 150 bp increase in revenue growth and 50 bp increase in gross margins relative to our base case assumptions. On the cost side we incorporate 25 bp of operating leverage relative to our base case. This yields CY21E EPS of US$1.50 (13% upside to base case EPS) on which we apply a 9x multiple to reflect better revenue trajectory.

Our Grey Sky Scenario (US$) **7.00**

Our grey sky scenario assumes faster revenue decline by 100 bp compared to our base case, as well as a 25 bp decrease in gross margins. In addition, for costs we incorporate 25 bp of increased operating expenses relative to our base case, owing to flat operating expenses with lower revenues. This yields CY20E EPS of US$1.21 (8% downside vs our base case), on which we apply a 6x multiple reflecting faster declining revenues.

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73
Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$14.84

CREDIT SUISSE

Intel Corp.

Perhaps not the most levered, but the most undervalued

Semiconductor Devices

INTC

Target price (12M, US$)
75.00

Outperform

- **Datacentre driving growth beyond PCs**. INTC's Data-centric Centre Group makes up ~50% of the total Rev and has grown at a 13%/14% 3/5-year CAGR and we expect CY20/21 +10%/9% YoY growth. DCG encompasses workload-optimised platforms for compute, storage and network functions. Within this segment, the data centre group (DCG) makes up 32% of the total Rev and has grown at 11%/10% 3/5-year CAGRs and we expect +14%/8% YoY growth for CY20/21. Market segments include cloud service providers, enterprise and government, and communications service providers. These offerings span the full spectrum from the data centre core to the network edge. We expect overall INTC CY20/21 Rev/EPS of $73.5 bn/$4.75 and $76.8 bn/$5.00, respectively, with DCG contributing $2.38/$2.52.
- **Our INTC bull thesis.** Our positive view on INTC is based on the following: (1) AI lowers analytics costs, unlocking the more than 98% of Data today that goes unanalysed, (2) Compute is more levered to data analytics than creation, as analytics' cost declines, new applications will drive accelerating Compute TAM—a rising king tide lifts all boats, (3) even with a share loss of 15-20%, underlying TAM growth should support DGC CAGR of 10-12%, (4) share loss is less than certain (scale still matters as R&D is now a larger fix cost than capex, INTC spends $2 of R&D for every $1 of AMD revenue), software, applications optimisation, and channel partner development is now equally critical for success (market share especially, "wallet" share is more resilient than expected), absolute growth Rev/NI since 2017 is equal to 1.4x/10.5x "2019-AMDs", and (5) Adjacencies (Memory, I/O, Connectivity, Packing) provide not only incremental TAM but also the needed IP to lower the cost of compute for customers—the Holy Grail for success.
- **Most undervalued play in Compute.** Current investor sentiment is still poor—despite 12+ upgrades since COVID-19—most are "getting out the way" NT but still negative of share loss longer term; thus, the stock is cheap, embedding what looks to be zero to negative LT growth versus our view that INTC can grow its data centre businesses at 8-12% CAGR and overall Rev at 3-5%—which should easily support a 15 x multiple on US$5.00 or our target price of US$75, even before we argue for sustained EPS growth. Reiterate our OUTPERFORM rating and US$75 target price—16x/15x CY20/21 EPS of US$4.75/US$5.00—still ~5+ turns below the Semi average.

Price (17 Jul 20, US$)	60.00
52-week price range	68.47 - 44.61
Market cap (US$ m)	254,040.00
Enterprise value (US$ m)	256,275

Research Analysts

John W. Pitzer
212 538 4610
john.pitzer@credit-suisse.com

Dalya Hahn
212 325 7843
dalya.hahn@credit-suisse.com

Eric Hu
212 325 4735
eric.hu@credit-suisse.com

Jerome Darling
212 325 3211
jerome.darling@credit-suisse.com

Financial and valuation metrics

Year		12/19A	12/20E	12/21E
EPS (Excl. ESO) (US$)		5.43	5.09	5.38
EPS (CS adj.,)		5.09	4.72	5.00
Prev. EPS (CS adj., US$)		-	-	-
P/E (CS adj.) (x)		11.8	12.7	12.0
P/E rel. (CS adj., %)		60.5	50.3	61.6
Revenue (US$ m)		71,965.0	73,478.0	76,750.0
Net Debt (US$ m)		11,911	2,235	-1,482
OCFPS (US$)		7.41	7.59	8.22
P/OCF (x)		8.1	7.9	7.3
Number of shares (m)	4,234.00	Price/Sales (x)		3.61
BV/share (Next Qtr., US$)	9.2	P/BVPS (x)		2.9
Net debt (Next Qtr., US$ m)	-6,693.0	Dividend (current, US$)		1.3
Dividend yield (%)	1.36			

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance

On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$50.27

Quarterly EPS	Q1	Q2	Q3	Q4
2019A	0.89	1.06	1.32	1.58
2020E	1.32	0.98	0.99	0.99
2021E	1.11	1.11	1.14	1.17

Intel Corp. (INTC)

Price (17 Jul 2020): **US$60.0**

Target Price: **75.00**

Analyst: **John Pitzer**

Rating: **Outperform**

Income Statement	12/19A	12/20E	12/21E
Revenue (US$ m)	**71,965.0**	**73,478.0**	**76,750.0**
EBITDA	**36,134.0**	**27,899.0**	**28,505.1**
Operating profit	**23,752.0**	**24,197.3**	**25,131.3**
Recurring profit	**25,775.0**	**23,413.3**	**24,731.3**
Cash Flow	**12/19A**	**12/20E**	**12/21E**
Cash flow from operations	**33,145**	**32,663**	**35,357**
CAPEX	(16,213)	(16,018)	(15,000)
Free cash flow to the firm	**16,932**	**16,645**	**20,357**
Cash flow from investments	**(1,405)**	**(16,486)**	**(15,000)**
Net share issue(/repurchase)	(12,826)	(10,057)	(7,999)
Dividends paid	(5,576)	(5,632)	(5,632)
Issuance (retirement) of debt	765	10,247	0
Other	72	726	0
Cash flow from financing activities	(17,565)	(4,716)	(13,631)
Effect of exchange rates	-	-	-
Changes in Net Cash/Debt	**(3,244)**	**9,676**	**3,717**
Net debt at end	11,911	2,235	(1,482)
Balance Sheet ($US)	**12/19A**	**12/20E**	**12/21E**
Assets			
Other current assets	1,713	2,997	2,997
Total current assets	**29,121**	**49,448**	**54,838**
Total assets	**136,726**	**160,664**	**167,850**
Liabilities			
Short-term debt	3,693	3,464	3,464
Total current liabilities	22,637	22,128	21,724
Long-term debt	25,308	36,455	36,455
Total liabilities	59,192	61,911	59,557
Shareholder equity	77,534	98,753	108,988
Total liabilities and equity	**136,726**	**160,664**	**168,545**
Net debt	11,911	2,235	(1,482)
Per share	**12/19A**	**12/20E**	**12/21E**
No. of shares (wtd avg)	4,473	4,303	4,300
CS adj. EPS	5.09	4.72	5.00
Prev. EPS (US$)	-	-	-
Dividend (US$)	1.25	1.31	1.31
Free cash flow per share	3.79	3.87	4.73
Earnings	**12/19A**	**12/20E**	**12/21E**
Sales growth (%)	1.6	2.1	4.5
Net profit growth (%)	3.9	(10.8)	6.0
EPS growth (%)	9.0	(6.4)	5.8
EBIT margin (%)	33.0	32.9	32.7
Valuation	**12/19A**	**12/20E**	**12/21E**
EV/Sales (x)	3.70	3.49	3.29
EV/EBIT (x)	11.2	10.6	10.0
P/E (x)	11.8	12.7	12.0

Quarterly EPS	Q1	Q2	Q3	Q4
2019A	0.89	1.06	1.32	1.58
2020E	1.32	0.98	0.99	0.99
2021E	1.11	1.11	1.14	1.17

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Intel Corporation is a semiconductor chip maker company. The Company develops advanced integrated digital technology products, primarily integrated circuits, components, such as microprocessors, chipsets, motherboards, wireless and wired connectivity.

Blue/Grey Sky Scenario

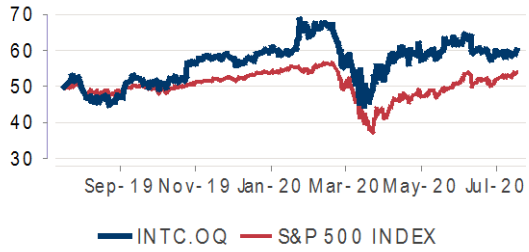
Our Blue Sky Scenario (US$) **90.00**

Our blue sky scenario assumes a reacceleration in DCG growth, healthy PC environment and sustainable operating leverage, driving upside to US$90.

Our Grey Sky Scenario (US$) **45.00**

In our grey sky scenario, should the macro backdrop worsen we see a floor at US$45 or ~3% dividend yield.

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73
Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$50.27

CREDIT SUISSE

International Business Machines

IBM + RHT stand ready to capitalise on the enterprise shift to cloud

IT Hardware

IBM

Target price (12M, US$)
150.00

Outperform

- **Red Hat a key differentiator looking towards a hybrid cloud future.** We believe the acquisition of Red Hat represents a landmark shift in strategy for IBM, significantly improving the company's standing in the rapid push towards hybrid cloud and paving the way for sustained revenue-driven EPS growth ahead. Specifically, the combination brings together the platform (with Red Hat's leading OpenShift offering), incumbency (given IBM's vast middleware installed base), and expertise (GBS) to help modernise the ~80% of applications that have yet to migrate to the public cloud. Indeed, we see an opportunity for IBM to not only accelerate Red Hat's standalone trajectory through its large enterprise salesforce, but also think "legacy" IBM gets pulled-through as well as customers look to leverage "core" IBM middleware (Cloud Paks) and the deep industry knowledge and technical know-how of IBM's Services organisation to help modernise apps
- **COVID-19 creates NT pause, but integration on track to drive acceleration ahead.** Following the acquisition, IBM has made a good early progress integrating Red Hat, including standardising its hybrid cloud platform on OpenShift + Cloud Paks, accelerating growth of Red Hat's core offerings with larger customer engagements (large deals up 50% YoY in 1Q, including the two biggest ever), and Services engagements with >100 clients using Red Hat technology. While the onset of COVID-19 likely drives a near-term pause in IT spend as companies reassess priorities, we believe IBM + Red Hat have now laid the foundation to capitalise on a trend of accelerating cloud adoption post-COVID-19. Services is a key piece of the opportunity, as we expect engagements to first materialise in Consulting followed by flow-through of App. Management projects as IBM helps customers migrate to the cloud.
- **Outperform rated, offering a good balance of offence and defence.** We remain firm that IBM + Red Hat is well positioned for the shift toward hybrid, and that the new CEO Arvind Krishna's balanced focus on investment and LT growth (rather than just NT profitability) should allow it to emerge stronger post-COVID-19, with the potential for sustained, revenue-driven EPS growth ahead. This remains an underappreciated narrative and continued execution along this path will be key to shifting the prevailing investor perception that IBM is a legacy business facing secular top-line pressure. In the current environment. We also think IBM offers a balanced blend of both offence and defence, supported by positioning in customers' mission-critical spend and a ~5% dividend yield.

Price (17 Jul 20, US$)	125.11
52-week price range	156.76 - 94.77
Market cap (US$ m)	111,084.16
Enterprise value (US$ m)	165,443

Research Analysts

Matthew Cabral
415 249 7929
matthew.cabral@credit-suisse.com

Dan Knauff, CFA
415 249 7925
daniel.knauff@credit-suisse.com

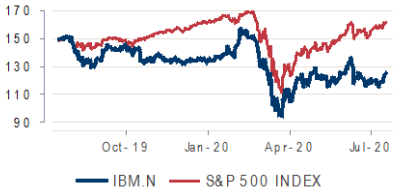
Michael Allen
415 249 7926
michael.allen@credit-suisse.com

Financial and valuation metrics

Year	12/19A	12/20E	12/21E	12/22E
EPS (Excl. ESO) (US$)	13.51	11.75	13.09	14.96
EPS (CS adj.,)	12.81	10.89	12.33	14.21
Prev. EPS (CS adj., US$)	-	-	-	-
P/E (CS adj.) (x)	9.8	11.5	10.1	8.8
P/E rel. (CS adj., %)	50.1	45.5	52.1	52.8
Revenue (US$ m)	77,148.0	73,937.2	75,864.9	79,267.0
Net Debt (US$ m)	59,986	54,359	49,257	44,099
OCFPS (US$)	16.54	20.49	18.36	18.79
P/OCF (x)	7.6	6.1	6.8	6.7
Number of shares (m)	887.89	Price/Sales (x)		1.49
BV/share (Next Qtr., US$)	22.3	P/BVPS (x)		5.1
Net debt (Next Qtr., US$ m)	58,751.3	Dividend (current, US$)		6.7
Dividend yield (%)	1.36			

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$149.68

Quarterly EPS	Q1	Q2	Q3	Q4
2019A	2.25	3.17	2.68	4.71
2020E	1.84	1.93	2.70	4.41
2021E	1.84	2.36	3.23	4.90

CREDIT SUISSE

International Business Machines (IBM)

Price (17 Jul 2020): **US$125.11** Target Price: **150.00**

Analyst: **Matthew Cabral**

Rating: **Outperform**

Income Statement	12/19A	12/20E	12/21E	12/22E
Revenue (US$ m)	**77,148.0**	**73,937.2**	**75,864.9**	**79,267.0**
EBITDA	**16,949.0**	**15,236.5**	**16,783.0**	**18,354.2**
Operating profit	**12,188.0**	**11,034.1**	**13,158.8**	**15,021.9**
Recurring profit	**12,503.5**	**10,242.2**	**12,616.2**	**14,691.8**
Cash Flow	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Cash flow from operations	**14,770**	**18,379**	**16,556**	**17,038**
CAPEX	(2,370)	(3,214)	(3,497)	(3,570)
Free cash flow to the firm	**12,400**	**15,165**	**13,059**	**13,468**
Cash flow from investments	**(26,936)**	**(6,354)**	**(5,097)**	**(5,170)**
Net share issue(/repurchase)	(1,534)	(61)	(40)	(40)
Dividends paid	(5,707)	(5,984)	(6,317)	(6,670)
Issuance (retirement) of debt	16,284	(3,144)	(6,000)	(6,000)
Other	0	0	(0)	(0)
Cash flow from financing activities	9,043	(9,189)	(12,357)	(12,710)
Effect of exchange rates	-	-	-	-
Changes in Net Cash/Debt	**(25,553)**	**5,627**	**5,101**	**5,158**
Net debt at end	59,986	54,359	49,257	44,099
Balance Sheet ($US)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Assets				
Other current assets	4,834	6,072	6,158	6,355
Total current assets	**38,420**	**39,961**	**39,384**	**39,605**
Total assets	**152,187**	**148,735**	**146,730**	**146,177**
Liabilities				
Short-term debt	8,797	11,642	11,642	11,642
Total current liabilities	37,701	40,790	41,142	41,578
Long-term debt	54,102	48,185	42,185	36,185
Total liabilities	131,201	126,131	120,424	114,756
Shareholder equity	20,985	22,603	26,306	31,421
Total liabilities and equity	**152,186**	**148,735**	**146,730**	**146,177**
Net debt	59,986	54,359	49,257	44,099
Per share	**12/19A**	**12/20E**	**12/21E**	**12/22E**
No. of shares (wtd avg)	893	897	902	907
CS adj. EPS	12.81	10.89	12.33	14.21
Prev. EPS (US$)	-	-	-	-
Dividend (US$)	6.43	6.72	7.06	7.41
Free cash flow per share	13.89	16.91	14.48	14.85
Earnings	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Sales growth (%)	(3.1)	(4.2)	2.6	4.5
Net profit growth (%)	(9.7)	(14.6)	13.9	15.9
EPS growth (%)	(7.3)	(15.0)	13.2	15.2
EBIT margin (%)	15.8	14.9	17.3	19.0
Valuation	**12/19A**	**12/20E**	**12/21E**	**12/22E**
EV/Sales (x)	2.22	2.24	2.11	1.96
EV/EBIT (x)	14.0	15.0	12.2	10.3
P/E (x)	9.8	11.5	10.1	8.8
Quarterly EPS	**Q1**	**Q2**	**Q3**	**Q4**
2019A	2.25	3.17	2.68	4.71
2020E	1.84	1.93	2.70	4.41
2021E	1.84	2.36	3.23	4.90

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

International Business Machines Corp. is an information technology company, which provides integrated solutions that leverage information technology and knowledge of business processes. This includes software, hardware, and services.

Blue/Grey Sky Scenario

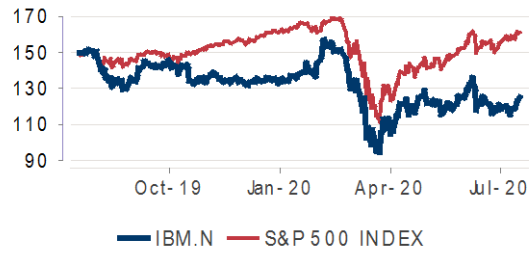
Our Blue Sky Scenario (US$) **194.00**

Our blue sky scenario assumes a 300 bp increase in revenue growth, a 50 bp increase in gross margins, and 50 bp decrease in opex as a % of sales relative to our base case assumptions. This yields CY21E EPS of US$13.87 (13% upside to base case EPS) on which we apply a 14x multiple to reflect a faster growth rate and the non-cash impact of the deferred revenue write-down.

Our Grey Sky Scenario (US$) **100.00**

Our grey sky scenario assumes a 500 bp decrease in CY20 revenue growth vs. our base case (easing to -300 bp in CY21), 100 bp of downward pressure on gross margins, and a 100 bp increase in opex as a % of sales. This yields CY21E EPS of US$10.00 (-19% vs. our base case EPS) on which we apply a 10x multiple to reflect a slower growth rate and negative leverage.

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73
Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$149.68

CREDIT SUISSE

Inventec Co Ltd

Cloud server growth offset by slower enterprise demand

2356.TW

IT Hardware

Target price (12M, NT$)
24.00

Neutral

- **Greater tilt towards traditional OEM business.** Inventec is also one of the early movers for IT infrastructure since 1998, despite its primary focus today still remaining on traditional OEM (60-70% of its server/storage sales), aside from some shares positioning across most of the hyperscalers in the US and China. As compared to other ODMs, we believe Inventec will see the best leverage to capture the long-term cloud IT infrastructure growth in China; however, the increasing ramp-up of this business will also lead to lower profitability, despite potentially better top-line momentum, as the projects are mostly evaluated based on periodic bidding, where it could also see intensifying competition from local OEMs including Inspur, Sugon, H3C, Lenovo, Huawei, etc.
- **Cloud outlook remains healthy.** We believe Inventec has one of the most diversified hyperscale customers base with exposure into both the US and China. Specifically, it ships the rack solutions directly to all leading China-based hyperscalers (i.e. Baidu, Alibaba and Tencent), while leveraging ZT Systems (Inventec a shareholder with about 20% share) in the US, providing custom-designed motherboards to Microsoft and Amazon, to minimise the risk of interest conflict with its brand customers, and also shipped directly to Google which operates its own final assembly. Overall, Inventec maintains its guidance for the cloud business to grow by double-digits percentage YoY in 2020, vs CSe of 15% YoY, amid COVID-19, as it expects healthy momentum from both China and US hyperscalers.
- **Traditional OEM weaker amid COVID-19.** We continue to remain more cautious on Inventec's enterprise business outlook, as we expect potentially weaker spending by enterprises due to weaker macro post the COVID-19 outbreak and lock-down into 2H, impacting its key customers' (HP and Dell) orders pull-in momentum. Overall, we forecast its enterprise sales to remain more flattish for +0.9% YoY in 2020E, in-line with the company's current guidance for flattish YoY change.
- **Reiterate NEUTRAL.** We raise our target price to NT$24.0 (from NT$21.5) based on the peak multiple 13x 2021E P/E. We could be more positive on Inventec if we see better progress in cloud from share gain and/or new customer wins. We believe the outlook for PC remains positive near-term from work-from-home, but will continue to monitor impacts from COVID-19 on its consumer-centric IAC business into 2H. We introduce 2022 estimates.

Previous target price (12M, NT$)	21.50
Price (17 Jul 20, NT$)	24.75
Upside/downside (%)	-3.0
Mkt cap (NT$/US$ mn)	88,790 / 3,015
Enterprise value (NT$ mn)	82,304
Number of shares (mn)	3,587
Free float (%)	70.0
52-wk price range (NT$)	27.70-18.75
ADTO-6M (US$ mn)	8.9

Research Analysts

Jerry Su
886 2 2715 6361
jerry.su@credit-suisse.com

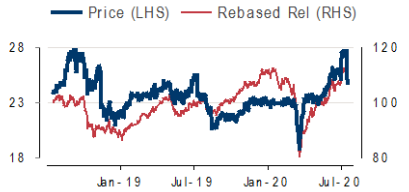
Harvie Chou
886 2 2715 6364
harvie.chou@credit-suisse.com

Financial and valuation metrics

Year	12/19A	12/20E	12/21E	12/22E
Revenue (NT$ mn)	500,953	514,236	540,750	558,639
EBITDA (NT$ mn)	10,557.2	10,865.6	11,762.3	12,410.0
EBIT (NT$ mn)	6,403.5	7,146.0	7,938.0	8,473.1
Net profit (NT$ mn)	5,508.0	8,613.0	6,604.7	7,046.6
EPS (CS adj.) (NT$)	1.54	2.4	1.84	1.96
Chg. from prev. EPS (%)	n.a.	1.9	(1.0)	n.a.
Consensus EPS (NT$)	n.a.	2.14	1.97	2.22
EPS growth (%)	(15.3)	56.4	(23.3)	6.7
P/E (x)	16.1	10.3	13.4	12.6
Dividend yield (%)	8.7	6.7	7.1	8.2
EV/EBITDA (x)	9.4	6.3	6.1	5.1
P/B (x)	1.56	1.63	1.65	1.46
ROE (%)	9.7	15.4	12.2	12.3
Net debt/equity (%)	18.4	(36.6)	(31.7)	(41.1)

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17/07/20. On 17/07/20 the spot exchange rate was NT$29.45/US$1

Performance	1M	3M	12M
Absolute (%)	(4.6)	4.9	6.2
Relative (%)	(10.2)	(10.1)	(6.6)

CREDIT SUISSE

Inventec Co Ltd (2356.TW / 2356 TT)

Price (17 Jul 2020): **NT$24.75** Target Price: **(from NT$21.50) NT$24.00**

Analyst: **Jerry Su**

Rating: **Neutral**

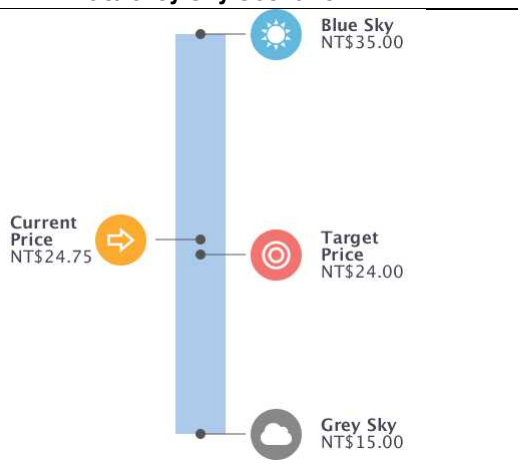
Income Statement (NT$ mn)	12/19A	12/20E	12/21E	12/22E
Sales revenue	**500,953**	**514,236**	**540,750**	**558,639**
Cost of goods sold	478,122	491,004	516,507	533,499
EBITDA	**10,557**	**10,866**	**11,762**	**12,410**
EBIT	**6,403**	**7,146**	**7,938**	**8,473**
Net interest expense/(inc.)	414	(477)	(611)	(728)
Recurring PBT	**6,509**	**12,097**	**8,180**	**8,752**
Profit after tax	**4,837**	**8,266**	**6,255**	**6,697**
Reported net profit	**5,508**	**8,613**	**6,605**	**7,047**
Net profit (Credit Suisse)	**5,508**	**8,613**	**6,605**	**7,047**
Balance Sheet (NT$ mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Cash & cash equivalents	18,953	49,085	46,865	54,179
Current receivables	89,246	87,539	92,292	94,768
Inventories	37,346	45,155	49,751	51,058
Other current assets	6,623	5,365	5,656	5,808
Current assets	**152,168**	**187,144**	**194,564**	**205,813**
Property, plant & equip.	30,729	31,618	31,439	30,347
Investments	3,184	3,412	3,412	3,412
Intangibles	881	0	0	0
Other non-current assets	6,131	6,529	6,529	6,529
Total assets	**193,093**	**228,703**	**235,943**	**246,100**
Current liabilities	**127,046**	**163,321**	**171,163**	**174,381**
Total liabilities	**136,122**	**173,363**	**181,311**	**184,421**
Total debt	29,409	28,845	29,563	28,831
Shareholders' equity	**57,093**	**54,579**	**53,872**	**60,918**
Minority interests	1,700	761	761	761
Total liabilities & equity	**193,093**	**228,703**	**235,943**	**246,100**
Cash Flow (NT$ mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
EBIT	**6,403**	**7,146**	**7,938**	**8,473**
Net interest	0	0	0	0
Tax paid	0	0	0	0
Working capital	4,519	27,243	(2,410)	(92)
Other cash & non-cash items	3,304	5,189	2,493	2,513
Operating cash flow	**14,227**	**39,577**	**8,021**	**10,893**
Capex	(3,818)	(4,560)	(2,800)	(2,000)
Free cash flow to the firm	**10,408**	**35,017**	**5,221**	**8,893**
Investing cash flow	**(14,861)**	**(13,476)**	**(9,247)**	**(6,847)**
Equity raised	0	0	0	0
Dividends paid	(5,919)	(4,682)	(7,752)	(5,944)
Financing cash flow	**(9,294)**	**3**	**1,436**	**(1,464)**
Total cash flow	**(9,928)**	**26,104**	**210**	**2,582**
Adjustments	0	0	0	0
Net change in cash	**(9,928)**	**26,104**	**210**	**2,582**
Per share	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Shares (wtd avg.) (mn)	3,587	3,587	3,587	3,587
EPS (Credit Suisse) (NT$)	**1.54**	**2.40**	**1.84**	**1.96**
DPS (NT$)	2.16	1.66	1.77	2.04
Operating CFPS (NT$)	3.97	11.03	2.24	3.04
Earnings	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Growth (%)				
Sales revenue	(1.2)	2.7	5.2	3.3
EBIT	(14.5)	11.6	11.1	6.7
EPS	(15.3)	56.4	(23.3)	6.7
Margins (%)				
EBITDA	2.1	2.1	2.2	2.2
EBIT	1.3	1.4	1.5	1.5
Valuation (x)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
P/E	16.1	10.3	13.4	12.6
P/B	1.56	1.63	1.65	1.46
Dividend yield (%)	8.7	6.7	7.1	8.2
EV/sales	0.2	0.1	0.1	0.1
EV/EBITDA	9.4	6.3	6.1	5.1
EV/EBIT	15.5	9.6	9.0	7.5
ROE analysis (%)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
ROE	9.7	15.4	12.2	12.3
ROIC	7.0	9.5	16.8	17.6
Credit ratios	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Net debt/equity (%)	18.4	(36.6)	(31.7)	(41.1)
Net debt/EBITDA (x)	0.99	(1.86)	(1.47)	(2.04)

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Founded in 1975, Inventec designs, manufactures and markets notebook PC, smartphones, servers & storage and various consumer electronic goods for brand companies.

Blue/Grey Sky Scenario



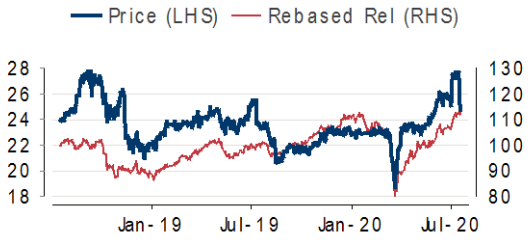
Our Blue Sky Scenario (NT$) **(from 25.00) 35.00**

In our blue sky scenario, our blue sky value of NT$35.0 assumes a better market momentum from overall PC market and share gain from its US customers. We also have more optimistic assumptions in its server/data-centre business from continuing better capex cycle. Lastly, we expect better momentum from its newly acquired projects, namely wireless Airpod and HomePod.

Our Grey Sky Scenario (NT$) **15.00**

In our grey sky scenario, our grey sky value of NT$15.0 assumes a worse-than-expected market momentum from the overall PC market. We also assume a worse-than-expected performance for PC and downward revision in Facebook capex guidance. Lastly, we expect worse-than-expected momentum from its newly acquired projects, namely wireless Airpod and HomePod.

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17-Jul-2020

On 17-Jul-2020 the spot exchange rate was NT$29.45/US$1

CREDIT SUISSE

Keppel DC REIT

Positioned to continue delivering growth

KEPE.SI

REITs

Target price (12M, S$)
2.91

Outperform

- **Stable organic growth profile.** KDC REIT is the only pure-play data centre REIT in Singapore, with its portfolio comprising primarily of colocation assets (72% revenue), while it caters mainly to wholesale tenants. The majority of KDC REIT's assets are located in Singapore (63% of AUM) where new data centre demand of 305 MW is expected to exceed the supply of only 290 MW from 2020-23. Only 4% and 9% of KDC REIT's leases are up for renewal in 2020-21 and the annual escalations of 2-4% will drive organic growth.
- **AEIs to supplement near-term growth.** KDC REIT has announced and delivered on multiple AEI opportunities across its portfolio, with the increased power capacity at KDC SGP 5 already committed, while further improvements at KDC Dublin 2 and development of Intellicentre 3 in Australia will drive incremental revenue through 2021. Robust demand has led to the feasibility of AEIs at KDC REIT's assets and will support near-term growth.
- **Acquisitions are key.** The main catalyst for the stock had been its strong acquisition track record, as assets were mostly acquired with cap rates >7%. Acquisitions will remain a key driver, and despite compressing cap rates, the REIT's deal pipeline mainly consists of assets priced at 6% and above. In comparison, KDC REIT trades at a dividend yield of 3.8%, while borrowing costs will be 1-3%. Thus future acquisitions will continue to be accretive, and acquiring another S$700 mn (similar to 2019) worth of assets at 6% yield implies ~9% accretion to DPU. Over the next 12 months, acquisitions are likely to be from third parties while sponsored assets continue to stabilise.
- **Best inorganic growth among S-REITs.** KDC REIT trades at FY20E yield of 3.8%, but has one of the strongest inorganic growth profiles among S-REIT peers, while it continues to see robust demand. KDC REIT trades at a CY20 FFO yield of 4.2% which is comparable to global DC peers at 3.5-4.3%; we have factored in S$1.5 bn worth of acquisitions over three years into our new target price of S$2.91 (from S$2.34).

Previous target price (12M, S$)	2.34
Price (20 Jul 20, S$)	2.66
Upside/downside (%)	9.6
Mkt cap (S$/US$ mn)	4,344 / 3,124
Enterprise value (S$ mn)	5,103
Number of shares (mn)	1,633
Free float (%)	65.0
52-wk price range (S$)	2.67-1.62
ADTO-6M (US$ mn)	13.5

Research Analysts

Nicholas Teh
65 6212 3026
nicholas.teh@credit-suisse.com

Louis Chua, CFA
65 6212 5721
louis.chua@credit-suisse.com

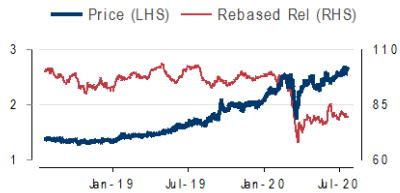
Terence Lee
65 6212 3011
terence.lee.2@credit-suisse.com

Financial and valuation metrics

Year	12/19A	12/20E	12/21E	12/22E
Net property income (S$ mn)	177.3	223.7	235.1	239.8
EBITDA (S$ mn)	155.0	194.2	204.7	209.1
Net attributable profit (S$ mn)	122.4	157.3	170.0	173.5
Distributable income (S$ mn)	113.2	156.1	170.0	174.9
EPS (CS adj.) (S$)	0.09	0.1	0.1	0.11
Consensus EPS (S$)	n.a.	0.09	0.1	0.11
EPS growth (%)	5.5	10.8	3.6	2.1
P/E (x)	29.4	26.5	25.6	25.0
DPU (S$)	0.08	0.09	0.1	0.1
Chg. from prev. DPU (%)	n.a.	1.9	2.2	n.a.
DPU yield (%)	2.9	3.4	3.7	3.8
P/B (x)	2.32	2.2	2.17	2.15
EV/ EBITDA (x)	33.0	26.3	25.2	24.6
ROE (%)	7.4	8.2	8.5	8.6
Net debt/equity (%)	40.2	37.5	39.5	38.9

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the FTSE STRAITS TIMES IDX which closed at 2,616.30 on 20/07/20. On 20/07/20 the spot exchange rate was S$1.39/US$1

Performance	1M	3M	12M
Absolute (%)	7.7	9.0	54.8
Relative (%)	8.4	6.5	77.3

CREDIT SUISSE

Keppel DC REIT (KEPE.SI / KDCREIT SP)

Price (20 Jul 2020): **S$2.66** Target Price: **(from S$2.34) S$2.91**

Analyst: **Nicholas Teh**

Rating: **Outperform**

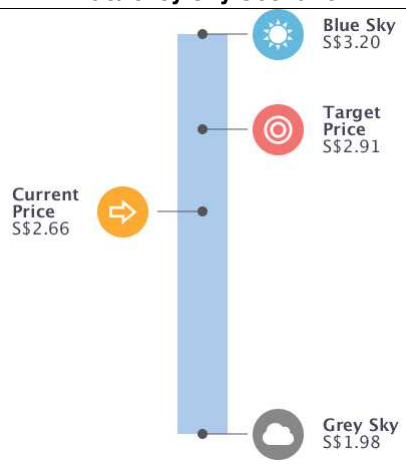
Income Statement (S$ mn)	12/19A	12/20E	12/21E	12/22E
Gross revenue	**195**	**245**	**257**	**263**
Property expenses	18	22	22	23
Net property income	**177**	**224**	**235**	**240**
EBITDA	**155**	**194**	**205**	**209**
Net interest expense/(inc.)	15	19	20	21
Recurring PBT	**140**	**175**	**184**	**188**
Net profit (Credit Suisse)	**122**	**157**	**170**	**174**
Distributable income	**113**	**156**	**170**	**175**
Balance Sheet (S$ mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Cash & cash equivalents	156	195	201	203
Current receivables	96	121	127	129
Current assets	**280**	**344**	**356**	**361**
Property, plant & equip.	0	0	0	0
Investment properties	2,637	2,732	2,807	2,828
Investment in Associates/JV	0	0	0	0
Total assets	**2,928**	**3,086**	**3,173**	**3,199**
Current liabilities	**108**	**124**	**127**	**129**
Long-term debt	880	911	967	967
Total liabilities	**1,018**	**1,063**	**1,124**	**1,125**
Unitholder funds	**1,903**	**2,015**	**2,042**	**2,066**
Capital employed	2,812	2,955	3,038	3,062
Cash Flow (S$ mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
EBIT	**155**	**194**	**205**	**209**
Net interest	0	0	0	0
Tax paid	13	15	12	12
Working capital	19	(9)	(2)	(1)
Other cash & non-cash items	(21)	(19)	(14)	(13)
Operating cash flow	**166**	**181**	**201**	**207**
Capex	(33)	(10)	(10)	(10)
Net property acq.	(609)	(125)	(57)	0
Investing cash flow	**(643)**	**(135)**	**(67)**	**(10)**
Equity raised	473	0	0	0
Dividends paid	(129)	(127)	(154)	(164)
Financing cash flow	**543**	**8**	**(120)**	**(186)**
Total cash flow	**66**	**54**	**14**	**11**
Adjustments	(2)	0	0	0
Net change in cash	**65**	**54**	**14**	**11**
Per share	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Shares (wtd avg.) (mn)	1,352	1,567	1,633	1,634
EPS (Credit Suisse) (S$)	0.09	0.10	0.10	0.11
DPU (S$)	**0.08**	**0.09**	**0.10**	**0.10**
BVPS (S$)	1.14	1.21	1.23	1.24
NAV per share (S$)	1.17	1.23	1.25	1.26
Earnings	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Growth (%)				
Gross revenue	11.0	25.9	4.9	2.2
Net property income	12.4	26.2	5.1	2.0
Net profit	12.7	28.5	8.0	2.1
Distributable income	19.6	37.9	8.9	2.9
DPU	4.0	18.8	9.6	2.9
Margins (%)				
Net property income	91.0	91.2	91.4	91.2
Pre-tax profit	71.7	71.3	71.7	71.6
Net profit	62.9	64.1	66.1	66.0
Valuation (x)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
P/E	29.4	26.5	25.6	25.0
DPU yield (%)	2.9	3.4	3.7	3.8
P/B	2.32	2.20	2.17	2.15
EV/EBITDA	33.0	26.3	25.2	24.6
Profitability (%)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
ROE	7.4	8.2	8.5	8.6
ROA	4.7	5.2	5.4	5.4
Credit ratios	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Net debt/equity (%)	40.2	37.5	39.5	38.9
Net debt/EBITDA (x)	4.93	3.89	3.94	3.85
Debt/asset (%)	31.4	30.8	31.8	31.5

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

The first data centre real estate investment trust (DC REIT) to be listed in Asia, Keppel DC REIT invests in a diversified portfolio of income-producing real estate.

Blue/Grey Sky Scenario



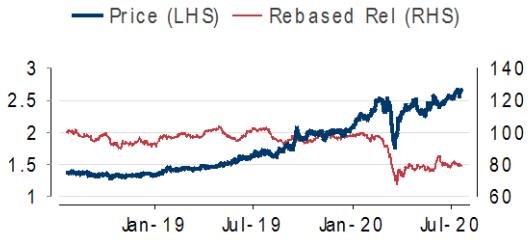
Our Blue Sky Scenario (S$) **(from 2.73) 3.20**

Further accretive acquisitions of S$2.5bn (assumes KDC REIT can double the size of its portfolio) at a spread of 3% over funding cost

Our Grey Sky Scenario (S$) **(from 1.38) 1.98**

Based on derating toward highest yield of large cap industrial REIT at 5%

Share price performance



The price relative chart measures performance against the FTSE STRAITS TIMES IDX which closed at 2,616.30 on 20-Jul-2020

On 20-Jul-2020 the spot exchange rate was S$1.39/US$1

CREDIT SUISSE

Lenovo Group Ltd

DCG still in investment stage

0992.HK

Target price (12M, HK$)
4.50

Neutral

IT Hardware

- **DCG still in investment stage.** Lenovo established DCG, after the purchase of x86 server business, as well as OEM/reseller on storage and related software solutions from IBM in 2014. Despite years of investments, this business continues to remain loss-making due to costs alignment, technology enhancement (cross-platforms products on Intel/AMD/ ARM), and transformation from a server-centric model to a solutions-based model surrounding SDI. We believe it will still take a few more years to record profitability, but we expect it will continue to see larger pressure in hyperscale markets, given ODM Direct trend take-off is adopted extensively by US hyperscalers, while its China hyperscale business should also see more intensive competition from local peers.
- **Focusing on Next Wave for longer-term growth.** Lenovo expects its DCG sales to see a better outlook in FY21 (FYE: March 2021), as it guided continued profitability improvement, vs US$226 mn loss in FY20, driven by improving cloud (currently ~30% of DCG sales) momentum, and demand uptick from increasing workload shift to the cloud amid COVID-19. It has already seen good progress with the Next Wave in China with key customers wins including Meituan, JD.com, Kuaishou, etc., and is looking to capitalise on the expanding opportunities with the 250 Next Wave customers through further sales force expansion.
- **Enterprise turning softer near-term.** Management recently indicated demand from enterprises has turned weaker since the beginning of the year, due to weakening macro as a result of the pandemic, despite good business ramp during the past year with sales growing over 5% YoY, supported by better SDI (+27% YoY) and storage (+54% YoY) through NetApp partnership in China, expanding its storage product portfolio coverage from 15% to 90% covering entry to the mid-range portfolio. We expect the enterprise segment to remain a drag in the near-term, but will continue to monitor the impacts from COVID-19.
- **Reiterate NEUTRAL.** We have a 12M target price of US$4.50 based on 10x 12M P/E. We believe Lenovo's DCG business still remains in transition, as it focuses on portfolio enhancement and sales force expansion. We could be more positive if we see better progress with the new Next Wave cloud customers' ramp, and improving enterprise momentum post the COVID-19 outbreak, along with more stable MBG profitability.

Price (17 Jul 20, HK$)	4.55
Upside/downside (%)	-1.1
Mkt cap (HK$/US$ mn)	54,667 / 7,050
Enterprise value (US$ mn)	8,586
Number of shares (mn)	12,015
Free float (%)	50.0
52-wk price range (HK$)	6.50-3.64
ADTO-6M (US$ mn)	28.6

Research Analysts

Jerry Su
886 2 2715 6361
jerry.su@credit-suisse.com

William Li
886 2 2715 6363
william.li@credit-suisse.com

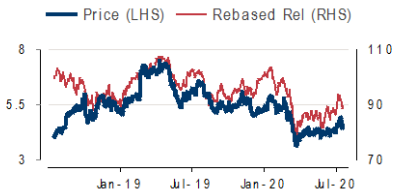
Harvie Chou
886 2 2715 6364
harvie.chou@credit-suisse.com

Financial and valuation metrics

Year	3/19A	3/20E	3/21E	3/22E
Revenue (US$ mn)	51,037.9	50,716.3	52,401.7	55,103.1
EBITDA (US$ mn)	1,973.3	2,304.4	2,356.0	2,543.5
EBIT (US$ mn)	1,177.5	1,438.2	1,416.0	1,603.5
Net profit (US$ mn)	596.0	664.8	666.7	825.4
EPS (CS adj.) (US$)	0.05	0.06	0.06	0.07
Chg. from prev. EPS (%)	n.a.	0.0	0.0	0.0
Consensus EPS (US$)	n.a.	0.05	0.06	0.07
EPS growth (%)	n.m.	11.3	0.4	23.8
P/E (x)	11.7	10.5	10.5	8.5
Dividend yield (%)	5.0	5.0	5.5	6.3
EV/EBITDA (x)	4.4	3.6	3.9	3.4
P/B (x)	1.59	1.67	1.56	1.43
ROE (%)	13.4	15.5	15.4	17.6
Net debt/equity (%)	41.9	32.2	47.2	32.2

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the HANG SENG INDEX which closed at 25,089.17 on 17/07/20. On 17/07/20 the spot exchange rate was HK$7.75/US$1

Performance	1M	3M	12M
Absolute (%)	7.1	3.9	(30.5)
Relative (%)	4.6	1.0	(18.7)

Lenovo Group Ltd (0992.HK / 992 HK)

Price (17 Jul 2020): **HK$4.55** Target Price: **HK$4.50**

Analyst: **Jerry Su**

Rating: **Neutral**

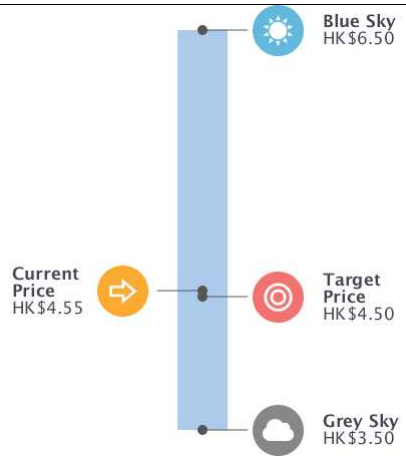
Income Statement (US$ mn)	03/19A	03/20E	03/21E	03/22E
Sales revenue	**51,038**	**50,716**	**52,402**	**55,103**
Cost of goods sold	43,667	42,359	43,858	46,117
EBITDA	**1,973**	**2,304**	**2,356**	**2,543**
EBIT	**1,178**	**1,438**	**1,416**	**1,603**
Net interest expense/(inc.)	310	406	350	340
Recurring PBT	**856**	**1,017**	**1,050**	**1,252**
Profit after tax	**657**	**804**	**797**	**939**
Reported net profit	**596**	**665**	**667**	**825**
Net profit (Credit Suisse)	**596**	**665**	**667**	**825**
Balance Sheet (US$ mn)	**03/19A**	**03/20E**	**03/21E**	**03/22E**
Cash & cash equivalents	2,663	3,551	2,804	3,325
Current receivables	10,462	9,834	11,830	12,115
Inventories	3,435	4,947	3,696	3,958
Other current assets	327	402	309	327
Current assets	**16,886**	**18,733**	**18,639**	**19,725**
Property, plant & equip.	2,127	2,515	2,555	2,595
Investments	600	611	611	611
Intangibles	8,325	7,985	7,325	6,665
Other non-current assets	2,051	2,284	2,284	2,284
Total assets	**29,988**	**32,128**	**31,414**	**31,880**
Current liabilities	**20,490**	**23,258**	**22,253**	**22,299**
Total liabilities	**25,891**	**28,069**	**27,063**	**27,110**
Total debt	4,380	4,860	4,860	4,860
Shareholders' equity	**4,390**	**4,191**	**4,482**	**4,902**
Minority interests	(293)	(132)	(132)	(132)
Total liabilities & equity	**29,988**	**32,128**	**31,414**	**31,880**
Cash Flow (US$ mn)	**03/19A**	**03/20E**	**03/21E**	**03/22E**
EBIT	**1,178**	**1,438**	**1,416**	**1,603**
Net interest	0	0	0	0
Tax paid	0	0	0	0
Working capital	(4,098)	194	(1,658)	(519)
Other cash & non-cash items	4,393	578	191	162
Operating cash flow	**1,473**	**2,210**	**(51)**	**1,246**
Capex	(701)	(953)	(320)	(320)
Free cash flow to the firm	**772**	**1,257**	**(371)**	**926**
Investing cash flow	**(700)**	**957**	**(320)**	**(320)**
Equity raised	0	0	0	0
Dividends paid	(404)	(431)	(376)	(405)
Financing cash flow	**123**	**(238)**	**(376)**	**(405)**
Total cash flow	**895**	**2,928**	**(747)**	**521**
Adjustments	(81)	(126)	0	0
Net change in cash	**815**	**2,802**	**(747)**	**521**
Per share	**03/19A**	**03/20E**	**03/21E**	**03/22E**
Shares (wtd avg.) (mn)	11,903	11,932	11,923	11,923
EPS (Credit Suisse) (US$)	**0.05**	**0.06**	**0.06**	**0.07**
DPS (US$)	0.03	0.03	0.03	0.04
Operating CFPS (US$)	0.12	0.19	(0.00)	0.10
Earnings	**03/19A**	**03/20E**	**03/21E**	**03/22E**
Growth (%)				
Sales revenue	12.5	(0.6)	3.3	5.2
EBIT	203.9	22.1	(1.5)	13.2
EPS	400.3	11.3	0.4	23.8
Margins (%)				
EBITDA	3.9	4.5	4.5	4.6
EBIT	2.3	2.8	2.7	2.9
Valuation (x)	**03/19A**	**03/20E**	**03/21E**	**03/22E**
P/E	11.7	10.5	10.5	8.5
P/B	1.59	1.67	1.56	1.43
Dividend yield (%)	5.0	5.0	5.5	6.3
EV/sales	0.2	0.2	0.2	0.2
EV/EBITDA	4.4	3.6	3.9	3.4
EV/EBIT	7.4	5.8	6.4	5.4
ROE analysis (%)	**03/19A**	**03/20E**	**03/21E**	**03/22E**
ROE	13.4	15.5	15.4	17.6
ROIC	14.7	20.3	18.3	18.9
Credit ratios	**03/19A**	**03/20E**	**03/21E**	**03/22E**
Net debt/equity (%)	41.9	32.2	47.2	32.2
Net debt/EBITDA (x)	0.87	0.57	0.87	0.60

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Lenovo Group Limited (Lenovo) is a personal technology company serving customers in more than 160 countries. The company is a personal computer (PC) vendor. It develops, manufactures and markets technology products and services.

Blue/Grey Sky Scenario



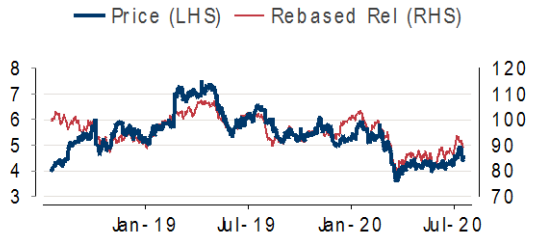
Our Blue Sky Scenario (HK$) **6.50**

Our blue sky value of HK$6.5 assumes a better market momentum for the PC business and PTI rebound and maintains >5% as component shortage issues no longer exist. We assume a faster turnaround for DCG under the leadership of ex-Intel VP, Kirk Skaugen, after the comprehensive server/data-centre solutions product launches recently.

Our Grey Sky Scenario (HK$) **3.50**

Our grey sky value of NT$3.5 assumes a worse-than-expected market momentum for the PC business and PTI continues to fall <5% as component shortage issues persist. We assume widening smartphone losses from new flagship model launch and China restructuring.

Share price performance



The price relative chart measures performance against the HANG SENG INDEX which closed at 25,089.17 on 17-Jul-2020

On 17-Jul-2020 the spot exchange rate was HK$7.75/US$1

CREDIT SUISSE

Micron Technology Inc.

It's a memory-centric world, complexity increasing

MU

Target price (12M, US$)
90.00

Outperform[V]

Semiconductor Devices

- **The computing world is more memory intensive.** DRAM specifically is more inelastic than elastic especially in the cloud (the primary function of DRAM is to keep a processor fed) and when processors are mostly contained in PCs, tablets, handsets where applications are "good enough" and utilisation is low (i.e., processors are not eating often) DRAM content has a low ceiling. However, when one moves processing power to the cloud, hyperscalers' primary economic driver is utilisation (the more highly they can utilise the datacentre the more profitable they will be) and high utilisation means processors want to eat all the time—increasing DRAM becomes a point of leverage at any price.
- **We have yet to see the impact of AI/ML workloads on DRAM demand.** These workloads are extremely memory/DRAM intensive. There is no cognition without memory. The DGX2, NVDA's ML server, has a maximum configuration of 1.5 TB of DRAM versus the average server of just 50 MB, and while the DGX2 has ~1/2 the processing power of the human brain (btw the DGX2 needs 3,200 watts, the brain's 32 watts; i.e., biology is still multiple orders of magnitude more efficient), the human brain still has been 100-300x the memory capacity of the DGX2. Most all of the private start-ups in semis are focused on solving the memory wall.
- **Valuation/opportunity in increasing complexity.** We see this long-term meaningful increase in memory content setting up for sustainably higher economic returns not reflected in the current valuation. We would highlight: (1) 5G handsets have as much as 6x/3x the DRAM/NAND content with penetration well below 10%, and (3) Memory to Logic ratio in consumer devices is 1:1, in enterprise servers ~6:1, hyperscale servers ~12:1, and AI servers ~35:1. F3Q/F4Q will be the 14th/15th consecutive quarter of positive FCF with cross-cycle GM/EBITDA/ROIC of +40%/+50%/20%—clearly indicative of a structural improving model. MU currently trades at 5.6x NTM EV/EBITDA, below its four-year trough average of ~6.7x; we reiterate our OUTPERFORM rating and target price of US$90 (~2.5x P/B FTM—top quartile average). We see downside at 1.2x book or ~US$39—implying $4 of upside for every $1 of downside—the best risk-reward in Semis.

Price (17 Jul 20, US$)	49.47
52-week price range	59.99 - 34.47
Market cap (US$ m)	54,961.09
Enterprise value (US$ m)	52,558

[V] = Stock Considered Volatile (see Disclosure Appendix)

Research Analysts

John W. Pitzer
212 538 4610
john.pitzer@credit-suisse.com

Dalya Hahn
212 325 7843
dalya.hahn@credit-suisse.com

Eric Hu
212 325 4735
eric.hu@credit-suisse.com

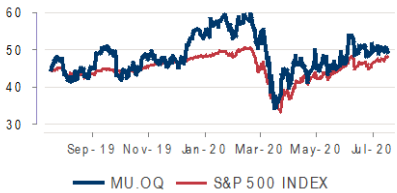
Jerome Darling
212 325 3211
jerome.darling@credit-suisse.com

Financial and valuation metrics

Year		8/19A	8/20E	8/21E
EPS (Excl. ESO) (US$)		6.31	2.80	5.23
Prev. EPS (Excl. ESO., US$)		-	-	-
EPS (CS adj.,)		6.17	2.59	4.99
P/E (Excl. ESO.) (x)		7.8	17.7	9.5
P/E rel. (Excl. ESO., %)		40.2	69.9	48.6
Revenue (US$ m)		23,406.0	21,379.0	24,200.0
Net Debt (US$ m)		-571	-2,403	-7,564
OCFPS (US$)		11.48	7.77	10.67
P/OCF (x)		4.3	6.4	4.6
Number of shares (m)	1,111.00	Price/Sales (x)		2.62
BV/share (Next Qtr., US$)	33.9	P/BVPS (x)		1.5
Net debt (Next Qtr., US$ m)	-2,795.0	Dividend (current, US$)		-
Dividend yield (%)	-			

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$45.52

Quarterly EPS	Q1	Q2	Q3	Q4
2019A	2.97	1.72	1.06	0.56
2020E	0.48	0.45	0.82	1.05
2021E	0.88	0.99	1.43	1.92

CREDIT SUISSE

Micron Technology Inc. (MU)

Price (17 Jul 2020): **US$49.47** Target Price: **90.00**

Analyst: **John Pitzer**

Rating: **Outperform [V]**

Income Statement	8/19A	8/20E	8/21E
Revenue (US$ m)	**23,406.0**	**21,379.0**	**24,200.0**
EBITDA	**13,285.0**	**8,985.0**	**12,955.6**
Operating profit	**7,812.0**	**3,401.4**	**6,668.5**
Recurring profit	**7,944.0**	**3,401.4**	**6,558.5**
Cash Flow	**8/19A**	**8/20E**	**8/21E**
Cash flow from operations	**13,189**	**8,870**	**12,162**
CAPEX	(9,855)	(8,000)	(7,000)
Free cash flow to the firm	**3,334**	**870**	**5,162**
Cash flow from investments	**(10,085)**	**(6,908)**	**(7,000)**
Net share issue(/repurchase)	(2,550)	(203)	0
Dividends paid	0	0	(1)
Issuance (retirement) of debt	210	714	0
Other	(98)	(646)	1
Cash flow from financing activities	(2,438)	(135)	0
Effect of exchange rates	-	-	-
Changes in Net Cash/Debt	**(1,298)**	**1,832**	**5,161**
Net debt at end	(571)	(2,403)	(7,564)
Balance Sheet ($US)	**8/19A**	**8/20E**	**8/21E**
Assets			
Other current assets	1,767	508	521
Total current assets	**16,503**	**18,659**	**23,305**
Total assets	**48,887**	**53,342**	**58,700**
Liabilities			
Short-term debt	1	1	2
Total current liabilities	6,390	6,739	7,430
Long-term debt	4,541	6,356	6,356
Total liabilities	13,007	14,642	15,334
Shareholder equity	34,992	38,602	43,270
Total liabilities and equity	**48,888**	**53,343**	**58,702**
Net debt	(571)	(2,403)	(7,564)
Per share	**8/19A**	**8/20E**	**8/21E**
No. of shares (wtd avg)	1,149	1,141	1,140
CS adj. EPS	6.17	2.59	4.99
Prev. EPS (US$)	-	-	-
Dividend (US$)	0.00	0.00	1.00
Free cash flow per share	2.90	0.76	4.53
Earnings	**8/19A**	**8/20E**	**8/21E**
Sales growth (%)	(23.0)	(8.7)	13.2
Net profit growth (%)	(51.1)	(58.3)	92.6
EPS growth (%)	(48.1)	(58.4)	96.8
EBIT margin (%)	33.4	15.9	27.6
Valuation	**8/19A**	**8/20E**	**8/21E**
EV/Sales (x)	2.32	2.46	1.96
EV/EBIT (x)	7.0	15.5	7.1
P/E (x)	8.0	19.1	9.9

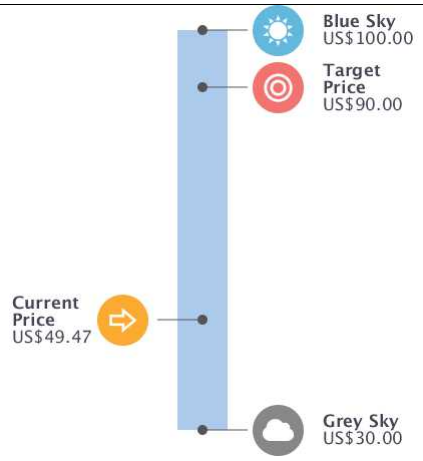
Quarterly EPS	Q1	Q2	Q3	Q4
2019A	2.97	1.72	1.06	0.56
2020E	0.48	0.45	0.82	1.05
2021E	0.88	0.99	1.43	1.92

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Micron Technology, Inc. is a manufacturer & marketer of semiconductor devices, principally dynamic random access memory, NAND Flash memory, as well as other innovative memory technologies, packaging solutions & semiconductor systems

Blue/Grey Sky Scenario



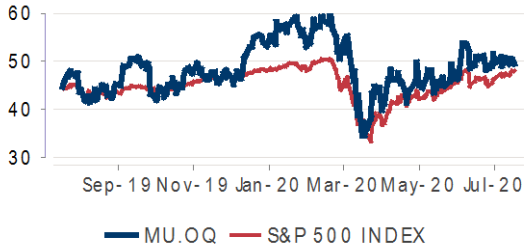
Our Blue Sky Scenario (US$) **100.00**

Our blue sky scenario of US$100 assumes ~11x EPS, sustainable industry growth, and reduced pricing volatility.

Our Grey Sky Scenario (US$) **30.00**

Our grey sky scenario of US$30 assumes trough EPS of ~US$3.75 and an 8x P/E multiple.

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73
Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$45.52

CREDIT SUISSE

MiTAC Holdings Corporation

The awakening titan

3706.TW

Target price (12M, NT$)
32.20

Neutral

IT Hardware

- **Initiate with NEUTRAL and TP of NT$32.2.** MiTAC is a leading cloud IT infrastructure ODM in Taiwan. After the corporate restructure in 2014, MiTAC Holding Corporation (MHC) was created along with three major business segments including MCT for cloud computing, MDT for auto and MIC for new services. We believe the market has largely priced-in the better near-term outlook with MCT post its strategic realignment in the past few years. Our 2020E EPS is still 19% below street, factoring in a more conservative outlook for enterprise demand in MCT, and in MDT due to continued weakness in automobile end-demand on softening macro during COVID-19.
- **MCT: Healthy cloud outlook on increasing workload shift to cloud.** We believe MiTAC will continue to benefit from increasing data workload shift to the cloud environment, especially driven by its key US hyperscale customer's (i.e. Amazon) data-centres ramp. We also believe the ongoing orders pull-in from its main OEM customer (Inspur) for the China hyperscalers remain healthy, providing good scale benefits on improving profitability profile post the restructure in recent years. However, we have concerns on enterprise demand into 2H, which could drive slower OEM orders pull-in, as this part of the business still consists of 30-35% of total units shipment by motherboard, including servers and storages.
- **MDT: continued outlook softness in auto impacting near-term orders.** We expect a weaker auto end-demand from a softer macro economy as a result of the COVID-19 global outbreak. This not only impacts its B2C products (dash cam and DVR) sales-through, but also enterprise's willingness to invest. We believe the recent lock-down and travel restrictions have also led to qualification push-off with B2B/B2B2C business.
- **Fairly valued.** MiTAC trades at 13x/9x/8x our 2020/2021/22E EPS, vs past three-year average of 10x within a range of 7-14x on street forward EPS. Our TP of NT$32.2 applies the mid-cycle 10x P/E, with improving MCT outlook offset by MDT weakness. Shares offer a 4.4% dividend yield on NT$1.0 cash/share (38% cash dividend payout) on 2019 EPS. Net cash per share was NT$4.1 as of 1Q20 for 12% of its market cap. **Key risks:** (1) better/weaker momentum with MCT; (2) improving/deteriorating auto end-demand; and (3) increasing/decreasing contribution from key non-op entities.

Price (17 Jul 20, NT$)	29.55
Upside/downside (%)	9.0
Mkt cap (NT$/US$ mn)	35,654 / 1,211
Enterprise value (NT$ mn)	32,368
Number of shares (mn)	1,207
Free float (%)	75.5
52-wk price range (NT$)	31.34-20.89
ADTO-6M (US$ mn)	14.4

Research Analysts

Harvie Chou
886 2 2715 6364
harvie.chou@credit-suisse.com

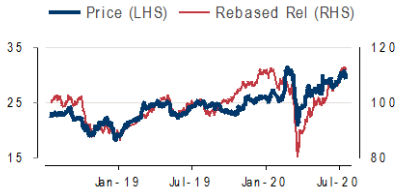
Jerry Su
886 2 2715 6361
jerry.su@credit-suisse.com

Financial and valuation metrics

Year	12/19A	12/20E	12/21E	12/22E
Revenue (NT$ mn)	35,832.0	41,550.9	49,917.8	57,155.8
EBITDA (NT$ mn)	1,421.7	1,400.6	2,186.2	2,979.2
EBIT (NT$ mn)	501.0	399.4	1,089.0	1,782.5
Net profit (NT$ mn)	2,817.9	2,765.7	3,881.2	4,453.1
EPS (CS adj.) (NT$)	2.34	2.29	3.22	3.69
Chg. from prev. EPS (%)	n.a	n.a	n.a	n.a
Consensus EPS (NT$)	n.a.	3.02	3.09	-
EPS growth (%)	(14.2)	(1.9)	40.3	14.7
P/E (x)	12.7	12.9	9.2	8.0
Dividend yield (%)	3.4	3.0	4.3	4.9
EV/EBITDA (x)	23.6	22.4	13.3	9.0
P/B (x)	0.91	0.89	0.83	0.78
ROE (%)	7.3	7.0	9.4	10.1
Net debt/equity (%)	(5.2)	(10.7)	(15.4)	(19.0)

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17/07/20. On 17/07/20 the spot exchange rate was NT$29.45/US$1

Performance	1M	3M	12M
Absolute (%)	5.7	7.3	18.8
Relative (%)	0.1	(7.7)	6.0

MiTAC Holdings Corporation (3706.TW / 3706 TT)

Analyst: **Harvie Chou**

Price (17 Jul 2020): **NT$29.55**

Target Price: **NT$32.20**

Rating: **Neutral**

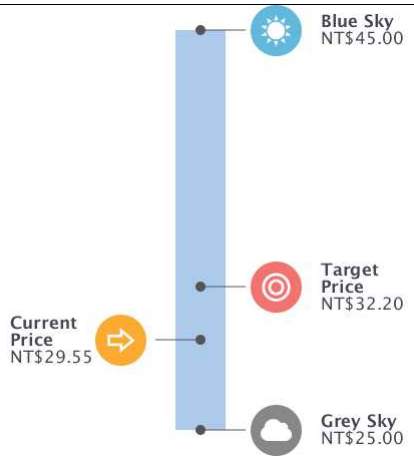
Income Statement (NT$ mn)	12/19A	12/20E	12/21E	12/22E
Sales revenue	**35,832**	**41,551**	**49,918**	**57,156**
Cost of goods sold	30,642	36,207	43,336	49,374
EBITDA	**1,422**	**1,401**	**2,186**	**2,979**
EBIT	**501**	**399**	**1,089**	**1,783**
Net interest expense/(inc.)	(33)	29	21	1
Recurring PBT	**3,083**	**2,953**	**4,224**	**4,859**
Profit after tax	**2,774**	**2,675**	**3,801**	**4,373**
Reported net profit	**2,818**	**2,766**	**3,881**	**4,453**
Net profit (Credit Suisse)	**2,818**	**2,766**	**3,881**	**4,453**
Balance Sheet (NT$ mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Cash & cash equivalents	6,665	8,255	10,545	12,673
Current receivables	6,697	7,140	8,006	9,065
Inventories	7,762	8,594	9,964	11,472
Other current assets	2,066	790	1,022	1,157
Current assets	**23,189**	**24,778**	**29,536**	**34,366**
Property, plant & equip.	7,811	7,072	7,261	7,350
Investments	23,374	23,141	23,141	23,141
Intangibles	1,036	1,025	1,025	1,025
Other non-current assets	0	0	0	0
Total assets	**55,410**	**56,016**	**60,963**	**65,883**
Current liabilities	**14,103**	**14,240**	**16,388**	**18,371**
Total liabilities	**15,856**	**15,984**	**18,133**	**20,120**
Total debt	4,595	3,980	3,980	3,980
Shareholders' equity	**39,171**	**39,912**	**42,711**	**45,643**
Minority interests	0	0	0	0
Total liabilities & equity	**55,345**	**55,896**	**60,843**	**65,763**
Cash Flow (NT$ mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
EBIT	**501**	**399**	**1,089**	**1,783**
Net interest	0	0	0	0
Tax paid	0	0	0	0
Working capital	(1,266)	(1,204)	(320)	(715)
Other cash & non-cash items	998	964	884	962
Operating cash flow	**233**	**159**	**1,653**	**2,029**
Capex	(1,623)	(1,198)	(1,200)	(1,200)
Free cash flow to the firm	**(1,390)**	**(1,038)**	**453**	**829**
Investing cash flow	**(2,542)**	**2,061**	**1,719**	**1,620**
Equity raised	1,405	1,293	0	0
Dividends paid	(1,384)	(1,077)	(1,082)	(1,520)
Financing cash flow	**3,304**	**(1,469)**	**(1,082)**	**(1,520)**
Total cash flow	**994**	**752**	**2,290**	**2,128**
Adjustments	(55)	(38)	0	0
Net change in cash	**939**	**714**	**2,290**	**2,128**
Per share	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Shares (wtd avg.) (mn)	1,207	1,207	1,207	1,207
EPS (Credit Suisse) (NT$)	**2.34**	**2.29**	**3.22**	**3.69**
DPS (NT$)	1.00	0.90	1.26	1.45
Operating CFPS (NT$)	0.19	0.13	1.37	1.68
Earnings	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Growth (%)				
Sales revenue	16.5	16.0	20.1	14.5
EBIT	50.0	(20.3)	172.7	63.7
EPS	(14.2)	(1.9)	40.3	14.7
Margins (%)				
EBITDA	4.0	3.4	4.4	5.2
EBIT	1.4	1.0	2.2	3.1
Valuation (x)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
P/E	12.7	12.9	9.2	8.0
P/B	0.91	0.89	0.83	0.78
Dividend yield (%)	3.4	3.0	4.3	4.9
EV/sales	0.9	0.8	0.6	0.5
EV/EBITDA	23.6	22.4	13.3	9.0
EV/EBIT	67.0	78.6	26.7	15.1
ROE analysis (%)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
ROE	7.3	7.0	9.4	10.1
ROIC	1.3	1.0	2.7	4.4
Credit ratios	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Net debt/equity (%)	(5.2)	(10.7)	(15.4)	(19.0)
Net debt/EBITDA (x)	(1.46)	(3.05)	(3.00)	(2.92)

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Founded in 1982, MiTAC was one of the pioneers for the R&D, manufacturing and sales of PC systems, but later diverged its focus entirely to the contracted manufacturing business model with also long experience and exposure in cloud infrastructure equipment.

Blue/Grey Sky Scenario



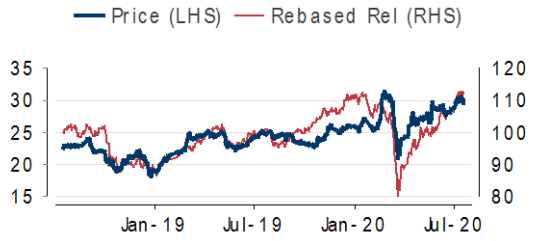
Our Blue Sky Scenario (NT$) **45.00**

Our blue sky scenario assumes an NT$45 value based on the peak multiple of 14x 2021E P/E, factoring in a better sales growth from MCT driven by increasing cloud IT equipment pull-in by key customer. We also factor in a better pace of recovery from MDT post COVID-19.

Our Grey Sky Scenario (NT$) **25.00**

Our grey sky scenario assumes an NT$25 target price based on the trough multiple of 8x 2021E P/E, factoring in a weaker sales growth from MCT due to slower enterprise spending, partially offset by stable cloud momentum. We also factor in a weaker prospect from MDT due to lower auto end demand as a result of lingering impacts from COVID-19.

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17-Jul-2020

On 17-Jul-2020 the spot exchange rate was NT$29.45/US$1

CREDIT SUISSE

NetApp

Data Fabric strategy increasingly important as cloud adoption accelerates

IT Hardware

NTAP

Target price (12M, US$)
53.00

Outperform[V]

- **Data Fabric strategy a key advantage.** NetApp's SW-based Data Fabric strategy is a clear differentiator vs. storage peers, and a key advantage in an increasingly hybrid-first world. Indeed, by extending its core ONTAP data management SW across on-prem environments and the three major public clouds, NetApp provides customers with consistency on the journey to hybrid cloud and allows them to "future-proof" investment in traditional storage arrays as they evaluate the ideal location for their various workloads over time. In addition to improving NetApp's positioning on-prem, the availability to run ONTAP natively in AWS, Azure and GCP increases their relevancy in the public cloud, particularly for cloud-native buyers that largely fall outside the traditional storage TAM. We acknowledge the ramp in their Cloud Data Services business has been disappointing to-date, but are encouraged by the recent uptick (+34% QoQ in F4Q), and will be looking for continued momentum in a post-COVID-19 world with faster adoption rates of public cloud here to stay as a much-needed offset to pressure on traditional HW spend.
- **Favourable all-flash product mix:** NetApp also benefits from outsized exposure to all-flash arrays (>60% of product), which remains one of the few consistent growth areas in traditional on-prem HW as falling SSD costs allow enterprises to take advantage of the performance benefits of all-flash for more price-sensitive workloads. We see significant runway for further adoption of all-flash arrays, both within NetApp's current installed base (~24% All-Flash) and the broader market (CSe: >50% share by CY21), combined with its SW-based advantages, enabling NetApp to outperform the overall external storage spending over time. Near-term, we are more cautious on the on-prem storage demand (both broadly and for NetApp specifically), with any rushed WFH/BCP spend likely behind us as pressure on IT budgets sets in, but highlight NetApp's incumbency as a relative advantage given the COVID-19 backdrop likely makes PoCs for new platforms more difficult and its established installed base provides a highly profitable recurring revenue to support the ongoing investment.
- **A relative winner in the push to hybrid; Outperform.** Despite a soft demand backdrop and potential margin risks as fading NAND cost tailwinds likely reverse ahead, we believe NetApp's Data Fabric strategy that enables a storage-centric approach to hybrid will be a key differentiator as cloud adoption accelerates. Further, we believe competitive concerns from Dell's new PowerStore launch are overblown and could actually present an opportunity, given a potentially disruptive upgrade process, with management keen to take advantage.

Price (17 Jul 20, US$)	44.81
52-week price range	65.38 - 35.35
Market cap (US$ m)	9,939.59
Enterprise value (US$ m)	8,010

[V] = Stock Considered Volatile (see Disclosure Appendix)

Research Analysts

Matthew Cabral
415 249 7929
matthew.cabral@credit-suisse.com

Dan Knauff, CFA
415 249 7925
daniel.knauff@credit-suisse.com

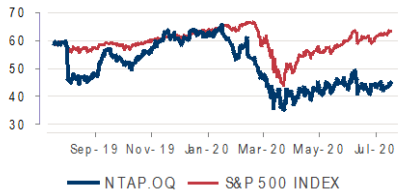
Michael Allen
415 249 7926
michael.allen@credit-suisse.com

Financial and valuation metrics

Year	4/20A	4/21E	4/22E	4/23E
EPS (Excl. ESO) (US$)	4.65	4.00	5.00	5.68
EPS (CS adj.,)	4.10	3.43	4.41	5.06
Prev. EPS (CS adj., US$)	-	-	-	-
P/E (CS adj.) (x)	10.9	13.1	10.2	8.9
P/E rel. (CS adj., %)	56.1	51.7	52.1	53.1
Revenue (US$ m)	5,412.0	4,973.4	5,306.0	5,497.6
Net Debt (US$ m)	-998	-1,930	-1,539	-1,328
OCFPS (US$)	4.56	4.44	5.28	6.38
P/OCF (x)	9.8	10.1	8.5	7.0
Number of shares (m)	221.82	Price/Sales (x)		1.95
BV/share (Next Qtr., US$)	3.2	P/BVPS (x)		24.0
Net debt (Next Qtr., US$ m)	-1,659.1	Dividend (current, US$)		1.9
Dividend yield (%)	1.07			

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$59.42

Quarterly EPS	Q1	Q2	Q3	Q4
2020A	0.65	1.09	1.16	1.24
2021E	0.43	0.88	0.99	1.10
2022E	0.72	1.10	1.28	1.32

NetApp (NTAP)

Price (17 Jul 2020): **US$44.81** Target Price: **53.00**

Analyst: **Matthew Cabral**

Rating: **Outperform [V]**

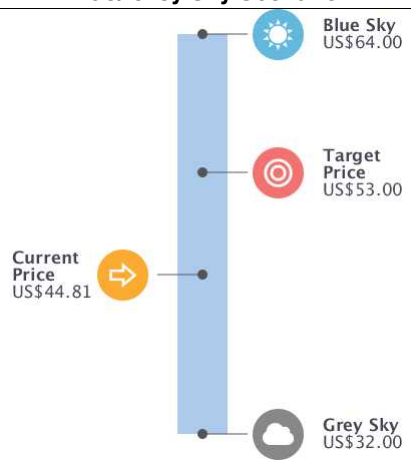
Income Statement	4/20A	4/21E	4/22E	4/23E
Revenue (US$ m)	**5,412.0**	**4,973.4**	**5,306.0**	**5,497.6**
EBITDA	**1,276.5**	**1,032.9**	**1,271.6**	**1,371.7**
Operating profit	**1,122.5**	**909.3**	**1,137.5**	**1,232.2**
Recurring profit	**1,141.5**	**950.2**	**1,193.4**	**1,288.1**
Cash Flow	**4/20A**	**4/21E**	**4/22E**	**4/23E**
Cash flow from operations	**1,060**	**1,008**	**1,171**	**1,331**
CAPEX	(124)	(124)	(133)	(137)
Free cash flow to the firm	**936**	**884**	**1,039**	**1,194**
Cash flow from investments	**1,076**	**(249)**	**(265)**	**(275)**
Net share issue(/repurchase)	(1,309)	0	(1,000)	(1,000)
Dividends paid	(439)	(432)	(422)	(397)
Issuance (retirement) of debt	(400)	0	0	0
Other	188	(8)	(8)	(8)
Cash flow from financing activities	(1,960)	(440)	(1,430)	(1,405)
Effect of exchange rates	-	-	-	-
Changes in Net Cash/Debt	**466**	**932**	**(391)**	**(211)**
Net debt at end	(998)	(1,930)	(1,539)	(1,328)
Balance Sheet ($US)	**4/20A**	**4/21E**	**4/22E**	**4/23E**
Assets				
Other current assets	490	483	498	509
Total current assets	**4,274**	**4,608**	**4,290**	**4,129**
Total assets	**7,522**	**7,670**	**7,363**	**7,203**
Liabilities				
Short-term debt	522	30	30	30
Total current liabilities	3,616	2,858	2,945	3,435
Long-term debt	1,146	1,150	1,150	750
Total liabilities	7,280	6,591	6,722	6,897
Shareholder equity	242	1,078	641	306
Total liabilities and equity	**7,522**	**7,670**	**7,363**	**7,203**
Net debt	(998)	(1,930)	(1,539)	(1,328)
Per share	**4/20A**	**4/21E**	**4/22E**	**4/23E**
No. of shares (wtd avg)	233	227	222	209
CS adj. EPS	4.10	3.43	4.41	5.06
Prev. EPS (US$)	-	-	-	-
Dividend (US$)	1.92	1.92	1.92	1.92
Free cash flow per share	4.03	3.89	4.69	5.72
Earnings	**4/20A**	**4/21E**	**4/22E**	**4/23E**
Sales growth (%)	(11.9)	(8.1)	6.7	3.6
Net profit growth (%)	(18.6)	(18.4)	25.8	7.9
EPS growth (%)	(9.2)	(16.4)	28.8	14.7
EBIT margin (%)	20.7	18.3	21.4	22.4
Valuation	**4/20A**	**4/21E**	**4/22E**	**4/23E**
EV/Sales (x)	1.65	1.61	1.58	1.57
EV/EBIT (x)	8.0	8.8	7.4	7.0
P/E (x)	10.9	13.1	10.2	8.9
Quarterly EPS	**Q1**	**Q2**	**Q3**	**Q4**
2020A	0.65	1.09	1.16	1.24
2021E	0.43	0.88	0.99	1.10
2022E	0.72	1.10	1.28	1.32

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

NetApp is a storage provider focusing on hybrid cloud and hybrid cloud services and solutions. Its data fabric strategy helps companies manage data across on-premise, cloud, and multi-cloud environments.

Blue/Grey Sky Scenario



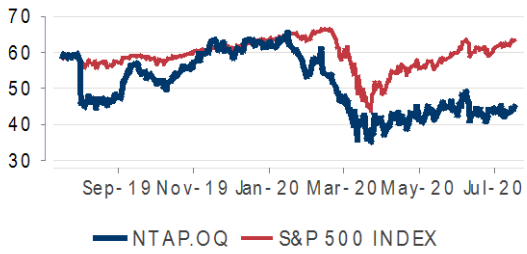
Our Blue Sky Scenario (US$) **64.00**

Our blue sky scenario assumes a 100 bp increase in revenue growth and 50 bp increase in gross margins, without reflecting any operating leverage. This yields CY21E EPS of US$4.28 (+4% vs. our base case) and drives a higher 15x multiple.

Our Grey Sky Scenario (US$) **32.00**

Our grey sky scenario reflects a 400 bp decrease in revenue growth and 200 bp downward pressure on gross margins, in addition to 300 bp of negative opex leverage. This yields CY21E EPS of US$2.91(-29% vs. our base case) and drives a lower 11x multiple.

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73
Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$59.42

CREDIT SUISSE

NVIDIA Corporation

Most levered to data economy, open-ended TAM

Semiconductor Devices

NVDA

Target price (12M, US$)
425.00
Outperform[V]

- **The data-driven economy underpins semi value capture, NVDA most levered.** Over the past five years, NVDA's Rev base has become more diversified and focused on its high-growth end markets, particularly in the Datacentre segment (~5% of Rev in FY2014 and ~20% of Rev in FY2018, and >27% in FY2020). Growth in the Datacentre segment (which has the highest margins out of NVDA's end markets) has coincided with increased profitability for the company (non-GAAP OpM of ~16% in FY2014 and ~38% in FY2019).
- **Data centre to grow within NVIDIA.** NVDA forecasts a US$50 bn TAM for its Datacentre business by FY2023 with new opportunities in high performance computing (HPC), Hyperscale computing, and Cloud computing. While we expect NVDA to control a decreasing share of the market throughout our forecast period as competition enters the space, we believe that this segment will continue to make up an increasing proportion of the total rev, reaching >40% of total revenue in FY202. Importantly, our analysis suggests the company could be significantly underestimating the market opportunity.
- **NVIDIA's moat helps it capture a good share of the growing compute TAM.** We estimate the Compute TAM is growing from ~US$90 bn to US$230 bn by 2025 (~15% CAGR). While the AI tech space should become increasingly crowded as competitors see the size of the opportunity, NVDA should benefit from capturing even a small percentage of Server TAM. Note, though NVDA has built sustainable moats in the Datacentre with CUDA and DGX/Volta, we conservatively modelled NVDA's share declining from 90% to 50% in Server Accelerators and the company can still maintain DC Rev at a +30% three-year CAGR (growing to ~44% of Rev from ~27% in FY20).
- **Outlook for 2020-21.** Recently, NVDA provided FY21 (CY20) opex of US$4.1 bn (+32% YoY), inclusive of MLNX, COVID-19, organic investment and an extra-week this FY. NVDA does not manage to forecast OpM but we would highlight that median opex/rev over the last 20 years has been ~26.5% and even at 27.5% the implied FY21 rev is ~$15 bn and thus underscoring our FY21/22/23 EPS of US$8.25/$9.90/$11.50. Our 12- month target price of US$425 is based on EV/FCF of 40x on CY22; in addition our target price represents an average P/E multiple of 35x to CY25 EPS of >US$15 discounted back.

Price (17 Jul 20, US$)	408.06
52-week price range	420.36 - 148.77
Market cap (US$ m)	250,956.90
Enterprise value (US$ m)	238,349

[V] = Stock Considered Volatile (see Disclosure Appendix)

Research Analysts

John W. Pitzer
212 538 4610
john.pitzer@credit-suisse.com

Dalya Hahn
212 325 7843
dalya.hahn@credit-suisse.com

Eric Hu
212 325 4735
eric.hu@credit-suisse.com

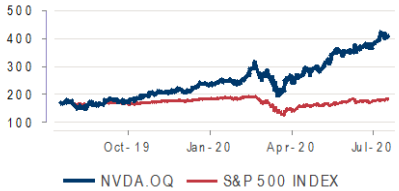
Jerome Darling
212 325 3211
jerome.darling@credit-suisse.com

Financial and valuation metrics

Year	12/19A	12/20E	12/21E	12/22E
EPS (Excl. ESO) (US$)	7.58	7.06	10.39	11.22
EPS (CS adj.,)	6.75	5.80	8.25	9.90
Prev. EPS (CS adj., US$)	-	-	-	-
P/E (CS adj.) (x)	60.4	70.4	49.5	41.2
P/E rel. (CS adj., %)	310.0	278.7	254.0	247.3
Revenue (US$ m)	11,716.0	10,918.0	14,900.0	17,130.0
Net Debt (US$ m)	-6,206	-12,607	-32,333	-55,539
OCFPS (US$)	6.00	7.74	12.73	10.05
P/OCF (x)	68.0	52.7	32.0	40.6
Number of shares (m)	615.00	Price/Sales (x)		22.47
BV/share (Next Qtr., US$)	15.8	P/BVPS (x)		18.9
Net debt (Next Qtr., US$ m)	-5,814.0	Dividend (current, US$)		-
Dividend yield (%)	-			

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$168.44

Quarterly EPS	Q1	Q2	Q3	Q4
2019A	2.05	1.94	1.84	0.80
2020E	0.88	1.24	1.78	1.89
2021E	1.80	1.94	2.15	2.35

NVIDIA Corporation (NVDA)

Price (17 Jul 2020): **US$408.06** Target Price: **425.00**

Analyst: **John Pitzer**

Rating: **Outperform [V]**

Income Statement	12/19A	12/20E	12/21E	12/22E
Revenue (US$ m)	**11,716.0**	**10,918.0**	**14,900.0**	**17,130.0**
EBITDA	**4,678.3**	**4,000.0**	**9,105.4**	**6,444.0**
Operating profit	**4,476.5**	**3,706.0**	**5,741.8**	**6,935.4**
Recurring profit	**4,558.5**	**3,860.0**	**5,619.8**	**6,771.4**
Cash Flow	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Cash flow from operations	**3,744**	**4,782**	**7,920**	**6,257**
CAPEX	(525)	(488)	(695)	(717)
Free cash flow to the firm	**3,219**	**4,294**	**7,225**	**5,540**
Cash flow from investments	**(4,265)**	**2,780**	**(1,595)**	**(717)**
Net share issue(/repurchase)	(925)	0	(983)	(1,748)
Dividends paid	(371)	(391)	(427)	(502)
Issuance (retirement) of debt	-	-	-	-
Other	(861)	(767)	19,779	19,916
Cash flow from financing activities	(2,157)	(1,158)	18,369	17,666
Effect of exchange rates	-	-	-	-
Changes in Net Cash/Debt	**1,098**	**6,401**	**19,725**	**23,206**
Net debt at end	(6,206)	(12,607)	(32,333)	(55,539)
Balance Sheet ($US)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Assets				
Other current assets	136	157	195	195
Total current assets	**11,329**	**17,391**	**41,739**	**66,358**
Total assets	**14,064**	**21,016**	**46,036**	**70,871**
Liabilities				
Short-term debt	0	0	0	0
Total current liabilities	1,329	1,784	1,142	1,993
Long-term debt	1,988	1,991	6,959	6,959
Total liabilities	3,950	5,111	9,394	10,245
Shareholder equity	10,114	15,905	36,642	60,626
Total liabilities and equity	**14,064**	**21,016**	**46,036**	**70,871**
Net debt	(6,206)	(12,607)	(32,333)	(55,539)
Per share	**12/19A**	**12/20E**	**12/21E**	**12/22E**
No. of shares (wtd avg)	624	618	622	623
CS adj. EPS	6.75	5.80	8.25	9.90
Prev. EPS (US$)	-	-	-	-
Dividend (US$)	0.00	0.00	0.00	0.00
Free cash flow per share	5.16	6.95	11.62	8.90
Earnings	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Sales growth (%)	(5.7)	(6.8)	36.5	15.0
Net profit growth (%)	(11.8)	(15.0)	43.3	20.1
EPS growth (%)	(11.5)	(14.2)	42.3	20.0
EBIT margin (%)	38.2	33.9	38.5	40.5
Valuation	**12/19A**	**12/20E**	**12/21E**	**12/22E**
EV/Sales (x)	20.89	21.83	14.67	11.41
EV/EBIT (x)	54.7	64.3	38.1	28.2
P/E (x)	60.4	70.4	49.5	41.2
Quarterly EPS	**Q1**	**Q2**	**Q3**	**Q4**
2019A	2.05	1.94	1.84	0.80
2020E	0.88	1.24	1.78	1.89
2021E	1.80	1.94	2.15	2.35

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Nvidia Corporation focuses on PC graphics, graphics processing unit (GPUs) and artificial intelligence (AI). The Company's processor has created platforms that address four markets: Gaming, Professional Visualisation, Datacentre, and Automotive.

Blue/Grey Sky Scenario

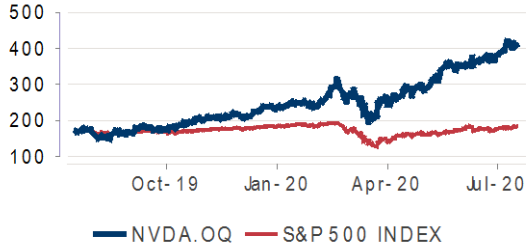
Our Blue Sky Scenario (US$) **475.00**

In the blue sky scenario, NVDA sees a full materialisation of its forecasted Datacentre and Autonomous vehicle TAMs of US$50 bn and US$60 bn, respectively, and NVDA maintains positions of leadership in both. Moreover, in this scenario, NVDA sees a successful launch of its Volta gaming chips, and sees continued positive secular trends in the Gaming industry. This will drive EPS of ~US$16 in FY2023, and the stock can be worth in US$475 at a 30x P/E.

Our Grey Sky Scenario (US$) **175.00**

In the grey sky scenario, NVDA sees increased competition from companies like INTC and AMD in the datacentre space, while internally-developed ASICs take market share as well. Also in this scenario, the proliferation of AV is delayed, as a result of increased regulation and other factors. Finally, AMD regains significant market share of the PC Gaming industry. This will drive EPS of ~US$7 in FY2023, and the stock can be worth US$175 at a 30x P/E.

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73
Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$168.44

CREDIT SUISSE

Parade Technologies

Limited contribution from PCIe4 in 2021

4966.TWO

Target price (12M, NT$)
970.00

Neutral

Semiconductor Devices

- **Leading data-centre high-speed interface provider.** Parade is a globally leading fabless IC design house focusing on the research and development of mixed-signal ICs and high-speed interfaces for a variety of consumer products including NB, smartphones, tablets, etc. It also started making more meaningful progress in the data-centre segment shipping PCIe3 redriver/retimer to US data centre customer as well as Chinese OEMs from 4Q17. Currently, Parade is the exclusive high-speed interface provider for PCIe4 (i.e. TI and IDTI key competitors in PCIe3) for 4-channel and 16-channel solutions adoptable on both Intel and AMD platforms (limited ARM/HiSilicon), as it claims its unique architecture offers a better power efficiency, lower latency, and better system performance. It is also working with Intel using a companion chip as an alternate solution for PCIe4 before the take-off.
- **Limited contribution from PCIe4 near-term.** Parade believes PCIe4 (16Gbps) spec upgrade from PCIe3 (8Gbps) to be key drivers, as it estimates the total addressable market of its PCIe4 products could reach US$200 mn for the next 3-4 years, while it aims for 30% of the overall share. In addition, despite the COVID-19 outbreak, Parade continues to hold its positive tone for 2020 with the aim to outgrow the overall semi industry, given its leadership in PCIe4, as it has already kicked-off mass production from 2Q for riser cards, and storage and AI machine in data-centre. It expects PCIe4 shipments to further pick-up in 4Q20 and 2021, as Intel's new chipset becomes available. It also believes PCIe4 will remain mainstream into 2022 as the next generation PCIe5 will not be ready to ramp in the next ~2 years, given higher entry barriers for new comers. We expect PCIe4's contribution to remain limited in 2020, and increase to 4% of sales in 2021E.
- **Share gain story intact.** Parade has secured more design-wins with China panel customers on eDP T-Con bundle-selling with SIPI IC for high-end NB, including gaming. We also see the recent acquisition on Fresco Logic offers a good opportunity for Parade to enter into MacBook and other i-Devices on USB4, given its know-how on DP, switch, converter, as well as Fresco's strength/IP in USB Host and Hub.
- **Reiterate NEUTRAL.** We recently downgraded Parade, as limited upside from the current level post over 100% run last 12M. However, we raise our TP to NT$970 (from NT$895) based on the peak multiple of 21x 2021E P/E. We would look for a better entry point to play the server and USB4 growth. We introduce our 2022 estimates.

Previous target price (12M, NT$)	895.00
Price (17 Jul 20, NT$)	1,075
Upside/downside (%)	-9.8
Mkt cap (NT$/US$ mn)	86,002 / 2,920
Enterprise value (NT$ mn)	77,634
Number of shares (mn)	80.00
Free float (%)	76.7
52-wk price range (NT$)	1,135-513
ADTO-6M (US$ mn)	35.9

Research Analysts

Jerry Su
886 2 2715 6361
jerry.su@credit-suisse.com

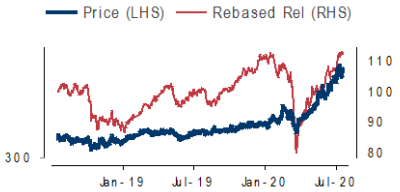
Harvie Chou
886 2 2715 6364
harvie.chou@credit-suisse.com

Financial and valuation metrics

Year	12/19A	12/20E	12/21E	12/22E
Revenue (NT$ mn)	11,810.6	14,033.8	15,747.8	17,700.2
EBITDA (NT$ mn)	2,885.8	3,709.0	4,328.1	4,743.9
EBIT (NT$ mn)	2,398.1	3,260.8	3,872.6	4,317.6
Net profit (NT$ mn)	2,433.8	3,128.5	3,696.1	4,109.8
EPS (CS adj.) (NT$)	30.61	39.14	46.25	51.42
Chg. from prev. EPS (%)	n.a.	6.6	3.4	n.a.
Consensus EPS (NT$)	n.a.	37.27	45.19	55.3
EPS growth (%)	22.3	27.9	18.2	11.2
P/E (x)	35.1	27.5	23.2	20.9
Dividend yield (%)	1.2	1.4	1.8	2.1
EV/EBITDA (x)	27.0	20.9	17.4	15.4
P/B (x)	7.59	6.43	5.54	4.82
ROE (%)	23.2	25.4	25.6	24.7
Net debt/equity (%)	(72.0)	(64.3)	(69.2)	(72.9)

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17/07/20. On 17/07/20 the spot exchange rate was NT$29.45/US$1

Performance	1M	3M	12M
Absolute (%)	16.0	55.3	103.6
Relative (%)	10.4	40.4	90.8

Parade Technologies (4966.TWO / 4966 TT)

Price (17 Jul 2020): **NT$1,075** Target Price: **(from NT$895.00) NT$970.00**

Analyst: **Jerry Su**

Rating: **Neutral**

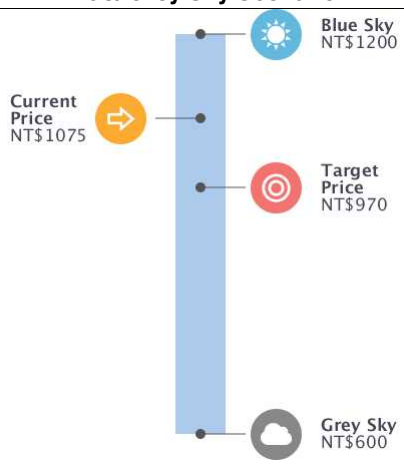
Income Statement (NT$ mn)	12/19A	12/20E	12/21E	12/22E
Sales revenue	**11,811**	**14,034**	**15,748**	**17,700**
Cost of goods sold	6,767	7,789	8,631	10,050
EBITDA	**2,886**	**3,709**	**4,328**	**4,744**
EBIT	**2,398**	**3,261**	**3,873**	**4,318**
Net interest expense/(inc.)	(106)	(96)	(111)	(138)
Recurring PBT	**2,516**	**3,366**	**3,996**	**4,467**
Profit after tax	**2,434**	**3,128**	**3,696**	**4,110**
Reported net profit	**2,434**	**3,128**	**3,696**	**4,110**
Net profit (Credit Suisse)	**2,434**	**3,128**	**3,696**	**4,110**
Balance Sheet (NT$ mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Cash & cash equivalents	8,106	8,581	10,732	12,982
Current receivables	1,198	1,661	1,963	2,169
Inventories	944	1,120	1,261	1,444
Other current assets	551	801	947	1,046
Current assets	**10,799**	**12,163**	**14,903**	**17,642**
Property, plant & equip.	278	220	156	116
Investments	0	0	0	0
Intangibles	2,375	2,339	2,339	2,339
Other non-current assets	321	1,499	1,463	1,448
Total assets	**13,773**	**16,221**	**18,861**	**21,546**
Current liabilities	**2,397**	**2,759**	**3,237**	**3,623**
Total liabilities	**2,513**	**2,867**	**3,345**	**3,731**
Total debt	0	0	0	0
Shareholders' equity	**11,260**	**13,355**	**15,517**	**17,814**
Minority interests	0	0	0	0
Total liabilities & equity	**13,773**	**16,221**	**18,861**	**21,546**
Cash Flow (NT$ mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
EBIT	**2,398**	**3,261**	**3,873**	**4,318**
Net interest	0	0	0	0
Tax paid	0	0	0	0
Working capital	443	(528)	(111)	(101)
Other cash & non-cash items	523	316	279	218
Operating cash flow	**3,364**	**3,049**	**4,040**	**4,435**
Capex	(77)	(104)	(100)	(100)
Free cash flow to the firm	**3,287**	**2,945**	**3,940**	**4,335**
Investing cash flow	**(491)**	**(1,532)**	**(356)**	**(372)**
Equity raised	85	184	0	(0)
Dividends paid	(981)	(1,217)	(1,534)	(1,812)
Financing cash flow	**(780)**	**(1,041)**	**(1,534)**	**(1,812)**
Total cash flow	**2,094**	**475**	**2,151**	**2,251**
Adjustments	0	0	0	0
Net change in cash	**2,094**	**475**	**2,151**	**2,251**
Per share	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Shares (wtd avg.) (mn)	80	80	80	80
EPS (Credit Suisse) (NT$)	**30.61**	**39.14**	**46.25**	**51.42**
DPS (NT$)	12.46	15.23	19.19	22.68
Operating CFPS (NT$)	42.31	38.14	50.55	55.49
Earnings	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Growth (%)				
Sales revenue	14.0	18.8	12.2	12.4
EBIT	22.9	36.0	18.8	11.5
EPS	22.3	27.9	18.2	11.2
Margins (%)				
EBITDA	24.4	26.4	27.5	26.8
EBIT	20.3	23.2	24.6	24.4
Valuation (x)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
P/E	35.1	27.5	23.2	20.9
P/B	7.59	6.43	5.54	4.82
Dividend yield (%)	1.2	1.4	1.8	2.1
EV/sales	6.6	5.5	4.8	4.1
EV/EBITDA	27.0	20.9	17.4	15.4
EV/EBIT	32.5	23.7	19.4	16.9
ROE analysis (%)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
ROE	23.2	25.4	25.6	24.7
ROIC	67.6	76.5	75.0	82.6
Credit ratios	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Net debt/equity (%)	(72.0)	(64.3)	(69.2)	(72.9)
Net debt/EBITDA (x)	(2.81)	(2.31)	(2.48)	(2.74)

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Parade is a fabless IC vendor focusing on the eDP T-Con and other high-speed interface products for applications including NBs, All-In-One PCs, tablets, etc.

Blue/Grey Sky Scenario



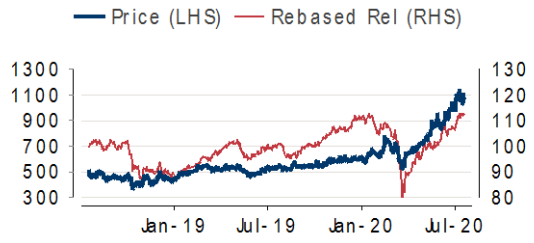
Our Blue Sky Scenario (NT$) **(from 950.00) 1,200**

Our blue sky scenario of NT$1,200 is based on 25x 12M P/E. In our blue sky scenario, we assume the growth from eDP T-Con and high-speed interface to accelerate, leading to a better margin profile. We use the peak cycle multiple of 25x to derive our blue sky TP.

Our Grey Sky Scenario (NT$) **(from 400.00) 600.00**

Our grey sky scenario of NT$600 is based on 12x 12M P/E. In our grey sky scenario, we assume muted growth for eDP T-Con and slower growth for high-speed interface. We also expect touch IC revenue to decline 20%+ due to lack of TDDI product. We apply a trough cycle multiple of 12x to derive our grey sky TP.

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17-Jul-2020

On 17-Jul-2020 the spot exchange rate was NT$29.45/US$1

CREDIT SUISSE

Quanta Computer

Diversified server play for cloud, enterprise, and 5G telco take-off

2382.TW

Target price (12M, NT$)
90.00

Outperform

IT Hardware

- **Leading Cloud IT infrastructure ODM.** Quanta is an industry pioneer kicking-off design and manufacturing of IT infrastructure since 2003, with foray into cloud from 2010 along with the establishment of key subsidiary QCT specifically for the segment in 2012. We expect Quanta/QCT to continue to maintain its leadership, supported by a diversified customer base with prominent shares across most of the leading US hyperscalers, as well as better progress with enterprises. We also believe carrier premise equipment and edge compute to be key drivers from 2021, along with further proliferation of 5G.
- **Prominent shares with the US hyperscalers.** We believe Quanta/QCT will continue to maintain its leadership in the ODM Direct space, leveraging its extensive experience in design and manufacturing. It has good share positioning with the US leading hyperscalers including Google and Facebook, with also exposure into most of the remaining Super 7 in the US and China (Microsoft, Amazon, Baidu and Alibaba). Quanta's recent guidance for the cloud in 2020 remains healthy for double-digits % YoY growth, vs CSe of +16% YoY, despite concerns about COVID-19. Management also reiterated its commitment for further capacity expansion in Taiwan, representing a key proportion of its NT$8-9 bn capex spending in 2020, as a result of the US/China trade tension started since 2H18.
- **Good business ramp in enterprise.** According to management, enterprise sales have been representing over 20% of its total IT infrastructure sales since 4Q19, with good coverage across Fortune 500, telecom equipment, telcos, unicorn, etc. We believe it is set for a second wave of transformation from cloud to the edge cooperating first with non-conventional Japan based telco Rakuten for the open-sourced carrier-premise equipment at the central and edge data-centres in 2019, and we expect this could be a key driver for Quanta from 2021 and in the future, as a leading ODM with a proven track record in the telco space, along with further proliferation of 5G.
- **Top pick for ODM.** We retain our OUTPERFORM rating and raise target price to NT$90.0 (from NT$75.0) on peak multiple of 16.5x 2021E P/E. Quanta is our top pick among Taiwan ODMs, as we believe its leadership will allow it to capitalise on the expanding cloud opportunities, as well as edge compute along with 5G proliferation. We expect the stock to advance on improving OPM and profitability, and better NB momentum. We introduce our 2022 estimates.

Previous target price (12M, NT$)	75.00
Price (17 Jul 20, NT$)	78.00
Upside/downside (%)	15.4
Mkt cap (NT$/US$ mn)	301,264 / 10,229
Enterprise value (NT$ mn)	308,968
Number of shares (mn)	3,862
Free float (%)	61.5
52-wk price range (NT$)	78.70-51.70
ADTO-6M (US$ mn)	22.8

Research Analysts

Jerry Su
886 2 2715 6361
jerry.su@credit-suisse.com

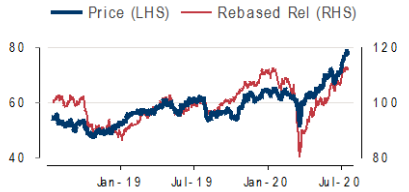
Harvie Chou
886 2 2715 6364
harvie.chou@credit-suisse.com

Financial and valuation metrics

Year	12/19A	12/20E	12/21E	12/22E
Revenue (NT$ mn)	1,029,611	1,022,091	1,051,142	1,070,418
EBITDA (NT$ mn)	28,409.4	27,466.9	31,829.3	34,310.5
EBIT (NT$ mn)	18,990.9	19,012.9	22,984.3	25,059.0
Net profit (NT$ mn)	15,942.7	17,702.6	20,789.0	22,497.7
EPS (CS adj.) (NT$)	4.13	4.58	5.38	5.82
Chg. from prev. EPS (%)	n.a.	1.9	5.1	n.a.
Consensus EPS (NT$)	n.a.	4.44	5.14	5.63
EPS growth (%)	5.5	11.0	17.4	8.2
P/E (x)	18.9	17.0	14.5	13.4
Dividend yield (%)	5.1	6.0	6.5	6.6
EV/EBITDA (x)	11.7	10.6	9.5	8.1
P/B (x)	2.1	2.18	2.17	1.87
ROE (%)	11.2	12.6	15.0	15.0
Net debt/equity (%)	21.4	(7.4)	0.3	(14.9)

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17/07/20. On 17/07/20 the spot exchange rate was NT$29.45/US$1

Performance	1M	3M	12M
Absolute (%)	14.5	24.2	26.6
Relative (%)	8.9	9.3	13.8

Quanta Computer (2382.TW / 2382 TT)

Price (17 Jul 2020): **NT$78.00** Target Price: **(from NT$75.00) NT$90.00**

Analyst: **Jerry Su**

Rating: **Outperform**

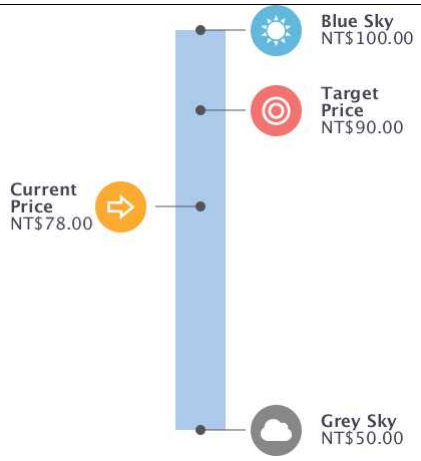
Income Statement (NT$ mn)	12/19A	12/20E	12/21E	12/22E
Sales revenue	**1,029,611**	**1,022,091**	**1,051,142**	**1,070,418**
Cost of goods sold	980,444	972,681	997,724	1,014,210
EBITDA	**28,409**	**27,467**	**31,829**	**34,310**
EBIT	**18,991**	**19,013**	**22,984**	**25,059**
Net interest expense/(inc.)	(516)	(950)	(1,085)	(1,276)
Recurring PBT	**20,552**	**23,134**	**26,628**	**28,772**
Profit after tax	**16,315**	**18,159**	**21,189**	**22,898**
Reported net profit	**15,943**	**17,703**	**20,789**	**22,498**
Net profit (Credit Suisse)	**15,943**	**17,703**	**20,789**	**22,498**
Balance Sheet (NT$ mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Cash & cash equivalents	192,606	167,298	156,089	181,556
Current receivables	204,314	226,257	234,492	235,740
Inventories	122,569	153,382	170,561	171,215
Other current assets	33,257	34,428	35,681	35,871
Current assets	**552,745**	**581,365**	**596,824**	**624,383**
Property, plant & equip.	47,497	44,603	41,757	38,506
Investments	2,611	2,694	2,694	2,694
Intangibles	832	0	0	0
Other non-current assets	10,941	11,645	11,645	11,645
Total assets	**614,627**	**640,307**	**652,920**	**677,227**
Current liabilities	**443,196**	**477,958**	**489,679**	**491,488**
Total liabilities	**472,696**	**496,313**	**508,033**	**509,842**
Total debt	222,985	156,592	156,592	156,592
Shareholders' equity	**143,212**	**137,999**	**138,892**	**161,390**
Minority interests	0	0	0	0
Total liabilities & equity	**614,627**	**640,307**	**652,920**	**677,227**
Cash Flow (NT$ mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
EBIT	**18,991**	**19,013**	**22,984**	**25,059**
Net interest	0	0	0	0
Tax paid	0	0	0	0
Working capital	22,056	24,535	(14,947)	(282)
Other cash & non-cash items	6,394	7,175	6,681	6,721
Operating cash flow	**47,441**	**50,722**	**14,718**	**31,498**
Capex	(6,961)	(6,732)	(4,800)	(4,800)
Free cash flow to the firm	**40,479**	**43,990**	**9,918**	**26,698**
Investing cash flow	**(26,530)**	**(19,009)**	**(15,631)**	**(15,631)**
Equity raised	0	0	0	0
Dividends paid	(13,133)	(13,849)	(15,378)	(18,059)
Financing cash flow	**(76,688)**	**(133,937)**	**0**	**0**
Total cash flow	**(55,777)**	**(102,224)**	**(913)**	**15,867**
Adjustments	0	0	0	0
Net change in cash	**(55,777)**	**(102,224)**	**(913)**	**15,867**
Per share	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Shares (wtd avg.) (mn)	3,863	3,863	3,863	3,863
EPS (Credit Suisse) (NT$)	**4.13**	**4.58**	**5.38**	**5.82**
DPS (NT$)	3.98	4.68	5.06	5.15
Operating CFPS (NT$)	12.28	13.13	3.81	8.15
Earnings	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Growth (%)				
Sales revenue	0.2	(0.7)	2.8	1.8
EBIT	32.8	0.1	20.9	9.0
EPS	5.5	11.0	17.4	8.2
Margins (%)				
EBITDA	2.8	2.7	3.0	3.2
EBIT	1.8	1.9	2.2	2.3
Valuation (x)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
P/E	18.9	17.0	14.5	13.4
P/B	2.10	2.18	2.17	1.87
Dividend yield (%)	5.1	6.0	6.5	6.6
EV/sales	0.3	0.3	0.3	0.3
EV/EBITDA	11.7	10.6	9.5	8.1
EV/EBIT	17.5	15.3	13.1	11.0
ROE analysis (%)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
ROE	11.2	12.6	15.0	15.0
ROIC	8.3	9.8	13.1	13.9
Credit ratios	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Net debt/equity (%)	21.4	(7.4)	0.3	(14.9)
Net debt/EBITDA (x)	1.07	(0.39)	0.02	(0.73)

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Quanta Computer Inc. is principally engaged in the research, development, manufacture and distribution of notebook computers. The company provides series products of notebook computers; wireless communication series products; LCD, etc.

Blue/Grey Sky Scenario



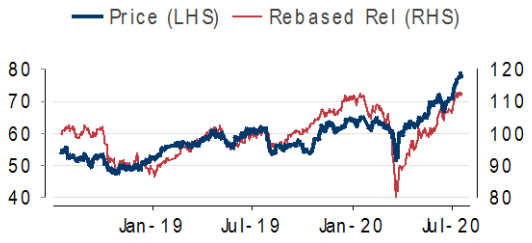
Our Blue Sky Scenario (NT$) **(from 85.00) 100.00**

Our blue sky value of NT$100.0 assumes a better market momentum from the overall PC market and share gain from its US customers. We also have more optimistic assumptions in its server/data-centre business from a continuing better capex cycle.

Our Grey Sky Scenario (NT$) **50.00**

Our grey sky value of NT$50.0 assumes a worse-than-expected market momentum from overall PC market. We also assume a worse-than-expected performance for PC and downward revision in Facebook capex guidance.

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17-Jul-2020

On 17-Jul-2020 the spot exchange rate was NT$29.45/US$1

CREDIT SUISSE

Samsung Electronics

Leadership into the next generation memory

005930.KS

FOCUS LIST STOCK

Target price (12M, W)
65,000

Outperform

Semiconductor Devices

- Samsung's highly diversified and vertically integrated business model is well positioned to benefit from global datacentre growth. Samsung dominates in the memory semiconductor production with ~50% market share and is the leading Server DRAM maker with 43% market share. It remains the gold standard in DRAM with the start of 1z nm process implementing EUV technology, development and usage of LP DDR5 (server DDR5 in 2021) and leading in HBM1 and HBM2 (High Bandwidth Memory) used with GPUs required in video intensity and AI computing. In NAND, it was the world's first to develop and produce 3D NAND and SSD for enterprise servers, which it currently dominates. Samsung remains the undisputed memory supplier of choice among the hyperscalers.
- Despite COVID-19 impacting global consumers, handsets, CE profits, driven by TVs and home appliance sales, remain strong through online sales globally. Cost reduction is aggressive on deep marketing and advertisement expenditures. While home appliance sales are likely to slow on seasonality, handset volumes will likely grow sharply into 3Q20 due to new product launches. DRAM/NAND ASP and bit shipments appear slightly stronger than expected providing some earnings upside. Although the display division remained in deep losses during 2Q20, OLED UTR should pick-up on new iPhone cycle by 3Q20 driving earnings recovery. Other customer wins for OLED on new 5G product launches should drive OLED recovery during 2H20.
- We remain confident about the continual earnings growth into 2021. Memory industry's capex cuts have remained in force since 2019, largely cleaning up inventory and causing price spikes despite much weaker demand caused by COVID-19. As the supply side remains tight, risks of sharp price declines are low. Additionally, the smartphone mix should improve to normalise profit margins as foldable products and 5G handsets become more mainstream and outsourcing to ODMs rise. Discontinuation of the TFT-LCD business will recover more than W1 tn in earnings on a YoY basis.
- Quarterly earnings growth should resume as handsets recover and OLED enters a new product cycle. We think yearly earnings will remain in a growth mode and should accelerate by 2021. We maintain our target price of W65,000 on 1.5x mid-cycle 2021E P/B target multiple.

Price (17 Jul 20, W)	54,400
Upside/downside (%)	19.5
Mkt cap (W/US$ bn)	324,756 / 269.86
Enterprise value (W bn)	305,244
Number of shares (mn)	5,970
Free float (%)	80.3
52-wk price range (W)	62,400-42,500
ADTO-6M (US$ mn)	991.2

Research Analysts

Keon Han
82 2 3707 3740
keon.han@credit-suisse.com

Sang Uk Kim
82 2 3707 3795
sang.kim@credit-suisse.com

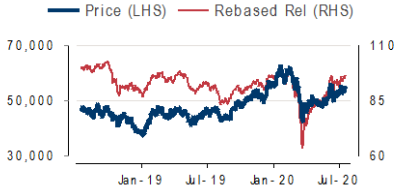
James Oh
82 2 3707 3764
james.oh@credit-suisse.com

Financial and valuation metrics

Year	12/19A	12/20E	12/21E
Revenue (W bn)	230,399	220,879	249,440
EBITDA (W bn)	61,920.8	63,301.7	79,259.9
EBIT (W bn)	27,772.9	30,829.6	43,819.0
Net profit (W bn)	21,743.7	23,925.5	33,506.3
EPS (CS adj.) (W)	3,192	3,513	4,919
Chg. from prev. EPS (%)	n.a.	0.0	0.0
Consensus EPS (W)	n.a.	3,776	5,328
EPS growth (%)	(51.0)	10.0	40.0
P/E (x)	17.0	15.5	11.1
Dividend yield (%)	2.6	2.6	2.6
EV/EBITDA (x)	5.1	4.7	3.5
P/B (x)	1.43	1.36	1.25
ROE (%)	8.6	9.0	11.8
Net debt/equity (%)	(3.2)	(10.3)	(14.9)

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the KOREA SE KOSPI IDX which closed at 2,201.19 on 17/07/20. On 17/07/20 the spot exchange rate was W1,203.44/US$1

Performance	1M	3M	12M
Absolute (%)	4.2	5.8	18.0
Relative (%)	1.4	(9.1)	11.5

CREDIT SUISSE

Samsung Electronics (005930.KS / 005930 KS)

Price (17 Jul 2020): **W54,400** Target Price: **W65,000**

Analyst: **Keon Han**
Rating: **Outperform**

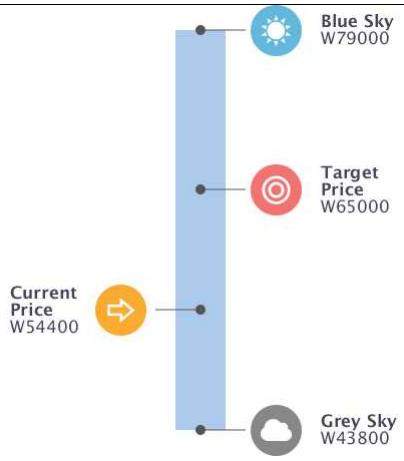
Income Statement (W bn)	12/19A	12/20E	12/21E
Sales revenue	**230,399**	**220,879**	**249,440**
Cost of goods sold	147,226	135,319	146,958
EBITDA	**61,921**	**63,302**	**79,260**
EBIT	**27,773**	**30,830**	**43,819**
Net interest expense/(inc.)	(1,890)	(1,410)	(1,680)
Recurring PBT	**30,433**	**32,850**	**45,899**
Profit after tax	**21,744**	**23,925**	**33,506**
Reported net profit	**21,744**	**23,925**	**33,506**
Net profit (Credit Suisse)	**21,744**	**23,925**	**33,506**
Balance Sheet (W bn)	**12/19A**	**12/20E**	**12/21E**
Cash & cash equivalents	26,886	43,044	59,258
Current receivables	39,369	35,060	39,594
Inventories	26,766	26,533	28,815
Other current assets	88,364	88,364	88,364
Current assets	**181,385**	**193,001**	**216,030**
Property, plant & equip.	119,825	115,905	114,982
Investments	7,592	7,592	7,592
Intangibles	20,704	23,121	25,539
Other non-current assets	23,059	19,248	19,248
Total assets	**352,564**	**358,867**	**383,391**
Current liabilities	**63,783**	**58,796**	**60,291**
Total liabilities	**89,684**	**82,539**	**84,034**
Total debt	18,394	14,584	14,584
Shareholders' equity	**259,765**	**273,212**	**296,241**
Minority interests	6,262	6,262	6,262
Total liabilities & equity	**352,564**	**358,867**	**383,391**
Cash Flow (W bn)	**12/19A**	**12/20E**	**12/21E**
EBIT	**27,773**	**30,830**	**43,819**
Net interest	0	0	0
Tax paid	0	0	0
Working capital	(2,546)	1,208	(5,320)
Other cash & non-cash items	20,156	22,138	21,368
Operating cash flow	**45,383**	**54,175**	**59,867**
Capex	(25,368)	(24,297)	(29,933)
Free cash flow to the firm	**20,015**	**29,879**	**29,934**
Investing cash flow	**(65,316)**	**(27,539)**	**(33,175)**
Equity raised	0	0	0
Dividends paid	(9,639)	(10,478)	(10,478)
Financing cash flow	**(9,485)**	**(10,478)**	**(10,478)**
Total cash flow	**(29,418)**	**16,158**	**16,214**
Adjustments	0	0	0
Net change in cash	**(29,418)**	**16,158**	**16,214**
Per share	**12/19A**	**12/20E**	**12/21E**
Shares (wtd avg.) (mn)	6,811	6,811	6,811
EPS (Credit Suisse) (W)	**3,192**	**3,513**	**4,919**
DPS (W)	1,416	1,416	1,416
Operating CFPS (W)	6,663	7,954	8,790
Earnings	**12/19A**	**12/20E**	**12/21E**
Growth (%)			
Sales revenue	(5.5)	(4.1)	12.9
EBIT	(52.9)	11.0	42.1
EPS	(51.0)	10.0	40.0
Margins (%)			
EBITDA	26.9	28.7	31.8
EBIT	12.1	14.0	17.6
Valuation (x)	**12/19A**	**12/20E**	**12/21E**
P/E	17.0	15.5	11.1
P/B	1.43	1.36	1.25
Dividend yield (%)	2.6	2.6	2.6
EV/sales	1.4	1.3	1.1
EV/EBITDA	5.1	4.7	3.5
EV/EBIT	11.4	9.6	6.4
ROE analysis (%)	**12/19A**	**12/20E**	**12/21E**
ROE	8.6	9.0	11.8
ROIC	8.2	8.9	12.7
Credit ratios	**12/19A**	**12/20E**	**12/21E**
Net debt/equity (%)	(3.2)	(10.3)	(14.9)
Net debt/EBITDA (x)	(0.14)	(0.45)	(0.56)

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Samsung Electronics manufactures and exports a wide range of consumer and industrial electronic equipment and products such as memory chips, TFT-LCD, personal computers, peripherals, monitors, televisions, and home appliances.

Blue/Grey Sky Scenario



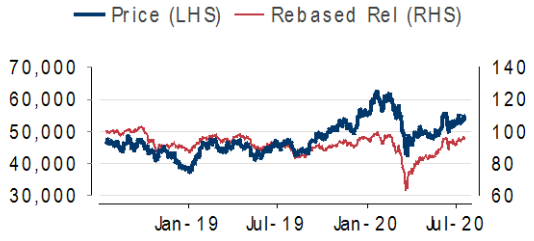
Our Blue Sky Scenario (W) **79,000**

Our blue sky scenario is based on: (1) better-than-expected smartphone shipments along with higher margin; (2) stronger OLED demand; and (3) more proactive shareholder return policy. Our blue sky scenario valuation (W79,000) is based on 1.8x P/B to FY21E EPS.

Our Grey Sky Scenario (W) **43,800**

Our grey sky scenario is based on: (1) weaker-than-expected smartphone demand; (2) worse-than-expected DRAM/NAND demand growth; and (3) any mis-execution on foldable smartphone launch. Our grey sky scenario valuation (W43,800) is based on 1.0x P/B to FY21E EPS.

Share price performance



The price relative chart measures performance against the KOREA SE KOSPI IDX which closed at 2,201.19 on 17-Jul-2020

On 17-Jul-2020 the spot exchange rate was W1,203.44/US$1

CREDIT SUISSE

Shengyi Technology

CCL leader riding on 5G/Datacom upcycle

600183.SS

Target price (12M, Rmb)
48.10
Outperform[V]

Electronic Components & Connectors

- **Beneficiary of 5G upcycle.** We estimate PCB (printed circuit board) content increases by almost 5x in 5G BTS vs 4G, plus an enlarged volume on higher coverage density. We anticipate the addressable market for PCB in 5G roll-out could reach Rmb84 bn/Rmb168 bn in China/worldwide and CCL demand in telecom about Rmb20 bn/Rmb40 bn in China/global, among which high-frequency CCL will reach Rmb6 bn/Rmb12 bn and high-speed CCL will reach Rmb10 bn/Rmb20 bn in China/global.
- **Datacom and automotive next drivers.** Apart from telecom infrastructure, we also anticipate boosting demand from datacom and automotive in 5G era: CCL demand in IDC could reach Rmb6.2/6.6/7.2 bn in 2020-22E while high-frequency CCL demand in mmWave radar could reach Rmb0.3/0.5/0.7 bn in 2020-22E.
- **Domestic substitution of high-end CCL.** Although China CCL companies have occupied large shares, they mainly concentrated on the low-end segment. Given the intense trade dispute and premium cost, we see an urgent need of domestic substitution in high-frequency and high-speed CCL. Shengyi is the leader among domestic CCL companies, and should become the key beneficiary and benefit from product mix improvement. We anticipate the high-frequency and high-speed CCL business to post revenue of Rmb3.5/6.7/9.9 bn in 2020-22E, implying a CAGR of 69%, with its contribution in total revenue reaching 22%/35%/43%.
- **OUTPERFORM.** Networking/server/automotive accounted for c.65% of Shengyi's revenue. We believe 5G and data trends are two sustainable drivers. We model NI to grow by 33%/29%/23% in 2020-22E, supported by 20% CAGR of revenue and GM improvement. Our TP of Rmb48.1 is based on 2021 EPS and 44x P/E (+0.5SD of A-share CCL peers' five-year historical average) and it is at a c.20% premium of the simple average of A-share peers with 28% NI CAGR and 20% ROE. **Key risks** include: trade tension, Huawei ban, pricing pressure, copper price fluctuation, 5G roll-out delays etc.

Price (20 Jul 20, Rmb)	29.75
Upside/downside (%)	61.7
Mkt cap (Rmb/US$ mn)	67,964 / 9,727
Enterprise value (Rmb mn)	68,783
Number of shares (mn)	2,285
Free float (%)	46.0
52-wk price range (Rmb)	34.82-14.50
ADTO-6M (US$ mn)	193.4

[V] = Stock Considered Volatile (see Disclosure Appendix)

Research Analysts

Kyna Wong
852 2101 6950
kyna.wong@credit-suisse.com

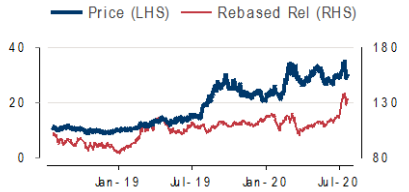
Clive Cheung
852 2101 7069
clive.cheung@credit-suisse.com

Financial and valuation metrics

Year	12/19A	12/20E	12/21E	12/22E
Revenue (Rmb mn)	13,241.1	15,865.5	19,176.6	23,132.7
EBITDA (Rmb mn)	2,353.3	3,161.5	4,093.9	4,862.7
EBIT (Rmb mn)	1,943.9	2,634.6	3,423.0	4,168.8
Net profit (Rmb mn)	1,438.7	1,928.7	2,486.4	3,062.4
EPS (CS adj.) (Rmb)	0.66	0.85	1.09	1.35
Chg. from prev. EPS (%)	n.a.	0.0	0.0	0.0
Consensus EPS (Rmb)	n.a.	0.84	1.04	1.24
EPS growth (%)	25.5	29.2	28.9	23.2
P/E (x)	45.3	35.1	27.2	22.1
Dividend yield (%)	1.4	1.8	2.3	2.8
EV/EBITDA (x)	29.6	21.6	16.9	14.1
P/B (x)	7.67	5.62	5.22	4.8
ROE (%)	18.9	18.5	19.9	22.6
Net debt/equity (%)	17.2	1.4	10.3	4.1

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the Shanghai Shenzhen CSI300 index which closed at 4,680.30 on 20/07/20. On 20/07/20 the spot exchange rate was Rmb6.99/US$1

Performance	1M	3M	12M
Absolute (%)	1.5	(4.3)	105.3
Relative (%)	(12.7)	(27.2)	82.4

Shengyi Technology (600183.SS / 600183 CH)

Price (20 Jul 2020): **Rmb29.75** Target Price: **Rmb48.10**

Analyst: **Kyna Wong**

Rating: **Outperform [V]**

Income Statement (Rmb mn)	12/19A	12/20E	12/21E	12/22E
Sales revenue	**13,241**	**15,866**	**19,177**	**23,133**
Cost of goods sold	9,713	11,336	13,483	16,254
EBITDA	**2,353**	**3,161**	**4,094**	**4,863**
EBIT	**1,944**	**2,635**	**3,423**	**4,169**
Net interest expense/(inc.)	42	99	99	99
Recurring PBT	**1,795**	**2,399**	**3,190**	**3,935**
Profit after tax	**1,553**	**2,057**	**2,735**	**3,374**
Reported net profit	**1,439**	**1,929**	**2,486**	**3,062**
Net profit (Credit Suisse)	**1,439**	**1,929**	**2,486**	**3,062**
Balance Sheet (Rmb mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Cash & cash equivalents	1,062	2,797	1,860	2,953
Current receivables	4,602	5,282	6,121	7,067
Inventories	2,100	2,091	2,302	2,552
Other current assets	947	947	947	947
Current assets	**8,712**	**11,116**	**11,230**	**13,520**
Property, plant & equip.	5,984	7,444	9,555	9,899
Investments	383	408	436	468
Intangibles	380	364	348	333
Other non-current assets	76	83	92	101
Total assets	**15,535**	**19,416**	**21,661**	**24,321**
Current liabilities	**5,257**	**5,832**	**6,980**	**8,285**
Total liabilities	**6,181**	**6,756**	**7,905**	**9,209**
Total debt	2,673	2,973	3,273	3,573
Shareholders' equity	**8,834**	**12,051**	**12,974**	**14,112**
Minority interests	520	609	782	999
Total liabilities & equity	**15,535**	**19,416**	**21,661**	**24,321**
Cash Flow (Rmb mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
EBIT	**1,944**	**2,635**	**3,423**	**4,169**
Net interest	0	0	0	0
Tax paid	(242)	(343)	(455)	(561)
Working capital	428	(696)	(553)	(553)
Other cash & non-cash items	(438)	261	404	422
Operating cash flow	**1,692**	**1,857**	**2,819**	**3,476**
Capex	(1,580)	(1,973)	(2,768)	(1,026)
Free cash flow to the firm	**112**	**(116)**	**51**	**2,450**
Investing cash flow	**(1,566)**	**(1,973)**	**(2,768)**	**(1,026)**
Equity raised	35	2,500	0	0
Dividends paid	(742)	(910)	(1,212)	(1,563)
Financing cash flow	**(173)**	**1,851**	**(987)**	**(1,357)**
Total cash flow	**(47)**	**1,735**	**(937)**	**1,093**
Adjustments	(3)	0	0	0
Net change in cash	**(50)**	**1,735**	**(937)**	**1,093**
Per share	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Shares (wtd avg.) (mn)	2,193	2,276	2,276	2,276
EPS (Credit Suisse) (Rmb)	**0.66**	**0.85**	**1.09**	**1.35**
DPS (Rmb)	0.42	0.53	0.69	0.85
Operating CFPS (Rmb)	0.77	0.82	1.24	1.53
Earnings	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Growth (%)				
Sales revenue	10.5	19.8	20.9	20.6
EBIT	41.5	35.5	29.9	21.8
EPS	25.5	29.2	28.9	23.2
Margins (%)				
EBITDA	17.8	19.9	21.3	21.0
EBIT	14.7	16.6	17.9	18.0
Valuation (x)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
P/E	45.3	35.1	27.2	22.1
P/B	7.67	5.62	5.22	4.80
Dividend yield (%)	1.4	1.8	2.3	2.8
EV/sales	5.3	4.3	3.6	3.0
EV/EBITDA	29.6	21.6	16.9	14.1
EV/EBIT	35.8	25.9	20.3	16.5
ROE analysis (%)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
ROE	18.9	18.5	19.9	22.6
ROIC	16.7	19.0	21.0	23.1
Credit ratios	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Net debt/equity (%)	17.2	1.4	10.3	4.1
Net debt/EBITDA (x)	0.68	0.06	0.34	0.13

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Shengyi is a principally engaged in the manufacture and distribution of copper clad laminates (CCLs), bonding sheets and PCBs. Its products are mainly used for making single, double-sided and multi-layer circuit boards, used in electronics.

Blue/Grey Sky Scenario

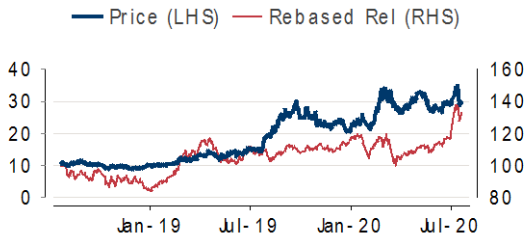
Our Blue Sky Scenario (Rmb) 66.90

Our blue sky scenario value of Rmb66.9 assumes higher sales, gross margin and lower opex-to-sales ratio with a 5x more multiple from the base case.

Our Grey Sky Scenario (Rmb) 32.40

Our grey sky scenario value of Rmb32.4 assumes lower sales, gross margin and higher opex-to-sales ratio with a 5x less multiple from the base case.

Share price performance



The price relative chart measures performance against the Shanghai Shenzhen CSI300 index which closed at 4,680.30 on 20-Jul-2020

On 20-Jul-2020 the spot exchange rate was Rmb6.99/US$1

CREDIT SUISSE

SK Hynix Inc.

Datacentre DRAM demand benefits Hynix's core competencies

000660.KS

Target price (12M, W)
118,000

Outperform

Semiconductor Devices

- With 37% of the global Server DRAM market share, SK Hynix has been a consistently reliable DRAM producer throughout its history. Hynix retains high customer satisfaction for quality and high performance Server DRAM products. Its Wuxi, China DRAM fab base, keeps manufacturing and distribution closest to its largest customer base in China. Hynix's NAND programme is still of a bit of work-in-progress, being late to 3D NAND transition and recent over-investment in 36L/72L NAND capacity. However, the severe losses are beginning to get mitigated as more 92L production expands. NAND sales to enterprise SSDs have started to drive mix improvement. Hynix is a pure memory company with 75% of revenue generated from more profitable DRAM products.
- Hynix's 2Q20 DRAM/NAND bit growth is tracking at flat/~8% QoQ guidance. Our 2Q20 OP estimate remains at W1.7 tn on richer Server DRAM mix and rapidly rising NAND productivity. DRAM ASP should surprise on the upside. Revenue mix of Server DRAM should approach 50% of DRAM sales and ASP increase should exceed 20%, given continual price hikes seen in 2Q20. Despite the Mobile DRAM channel inventory being filled, ASP is not falling as wafer conversion continues from mobile to servers. NAND losses are improving. OPM recovered from -70% in 2Q19 to -21% in 1Q20. SSD portion improved to 52% by 1Q20 vs 2019 average of 43%, and enterprise SSD sales are growing, driving up bit volume and ASP increase that is absorbing the rise in fixed costs.
- DRAM demand visibility is now extending to 3Q20. Changes at the margin include more of 3Q20 DRAM production being matched with customer backlog and confidence building that ASP will not fall sharply in 3Q20 either. Early producers' indication suggests blended ASP could remain flat to down low-single digits QoQ. NAND losses are moderating. Getting the NAND business right will be the critical factor given the W3.0/W1.0 tn loss in 2019/2020. Hynix plans to further cut capex in 2020 by 25% to 30% on a YoY basis to ensure inventory correction and ASP remains firm in 2021.
- We maintain our TP of W118k on mid-cycle 2021E P/B of 1.4x. Despite the uncertainty around COVID-19, we still see core OP growing over 100% YoY on memory cycle recovery.

Price (17 Jul 20, W)	82,900
Upside/downside (%)	42.3
Mkt cap (W/US$ bn)	60,351 / 50.15
Enterprise value (W bn)	67,856
Number of shares (mn)	728.00
Free float (%)	72.6
52-wk price range (W)	105,000-69,000
ADTO-6M (US$ mn)	307.0

Research Analysts

Keon Han
82 2 3707 3740
keon.han@credit-suisse.com

Sang Uk Kim
82 2 3707 3795
sang.kim@credit-suisse.com

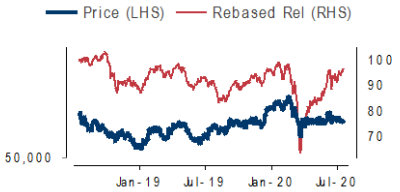
James Oh
82 2 3707 3764
james.oh@credit-suisse.com

Financial and valuation metrics

Year	12/19A	12/20E	12/21E
Revenue (W bn)	26,991.0	31,615.7	38,364.6
EBITDA (W bn)	11,266.9	15,791.2	21,462.2
EBIT (W bn)	2,712.2	5,980.0	11,046.1
Net profit (W bn)	2,016.2	4,322.9	8,112.0
EPS (CS adj.) (W)	2,948	6,320	11,860
Chg. from prev. EPS (%)	n.a.	0.0	0.0
Consensus EPS (W)	n.a.	6,304	11,588
EPS growth (%)	(87.0)	114.4	87.7
P/E (x)	28.1	13.1	7.0
Dividend yield (%)	0.0	0.0	0.0
EV/EBITDA (x)	6.1	4.2	2.9
P/B (x)	1.14	1.06	0.93
ROE (%)	4.0	8.4	14.2
Net debt/equity (%)	18.6	12.7	3.9

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the KOREA SE KOSPI IDX which closed at 2,201.19 on 17/07/20. On 17/07/20 the spot exchange rate was W1,203.44/US$1

Performance	1M	3M	12M
Absolute (%)	(4.5)	(1.4)	11.0
Relative (%)	(7.3)	(16.4)	4.5

CREDIT SUISSE

SK Hynix Inc. (000660.KS / 000660 KS)

Analyst: **Keon Han**

Price (17 Jul 2020): **W82,900**

Target Price: **W118,000**

Rating: **Outperform**

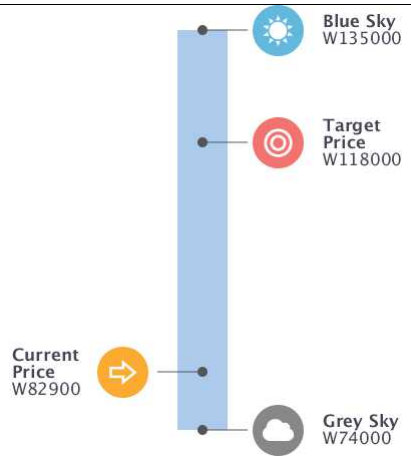
Income Statement (W bn)	12/19A	12/20E	12/21E
Sales revenue	**26,991**	**31,616**	**38,365**
Cost of goods sold	18,825	19,687	20,029
EBITDA	**11,267**	**15,791**	**21,462**
EBIT	**2,712**	**5,980**	**11,046**
Net interest expense/(inc.)	208	238	211
Recurring PBT	**2,443**	**5,697**	**10,535**
Profit after tax	**2,016**	**4,323**	**8,112**
Reported net profit	**2,016**	**4,323**	**8,112**
Net profit (Credit Suisse)	**2,016**	**4,323**	**8,112**
Balance Sheet (W bn)	**12/19A**	**12/20E**	**12/21E**
Cash & cash equivalents	1,310	3,551	6,722
Current receivables	4,251	5,269	6,394
Inventories	5,229	5,469	5,564
Other current assets	2,826	2,826	2,826
Current assets	**13,616**	**17,116**	**21,507**
Property, plant & equip.	39,941	40,250	42,296
Investments	806	806	806
Intangibles	2,556	2,432	2,309
Other non-current assets	6,844	6,844	6,844
Total assets	**63,763**	**67,447**	**73,761**
Current liabilities	**8,063**	**6,638**	**6,695**
Total liabilities	**16,596**	**16,641**	**15,698**
Total debt	10,522	10,424	9,424
Shareholders' equity	**49,825**	**53,464**	**60,721**
Minority interests	(0)	(0)	(0)
Total liabilities & equity	**63,763**	**67,447**	**73,761**
Cash Flow (W bn)	**12/19A**	**12/20E**	**12/21E**
EBIT	**2,712**	**5,980**	**11,046**
Net interest	0	0	0
Tax paid	0	0	0
Working capital	(377)	(1,115)	(1,163)
Other cash & non-cash items	8,336	8,675	8,204
Operating cash flow	**10,671**	**13,541**	**18,087**
Capex	(13,496)	(10,117)	(12,660)
Free cash flow to the firm	**(2,825)**	**3,424**	**5,427**
Investing cash flow	**(13,896)**	**(10,518)**	**(13,061)**
Equity raised	0	0	0
Dividends paid	(1,027)	(684)	(855)
Financing cash flow	**2,186**	**(782)**	**(1,855)**
Total cash flow	**(1,039)**	**2,241**	**3,171**
Adjustments	0	0	0
Net change in cash	**(1,039)**	**2,241**	**3,171**
Per share	**12/19A**	**12/20E**	**12/21E**
Shares (wtd avg.) (mn)	684	684	684
EPS (Credit Suisse) (W)	**2,948**	**6,320**	**11,860**
DPS (W)	0	0	0
Operating CFPS (W)	15,600	19,796	26,443
Earnings	**12/19A**	**12/20E**	**12/21E**
Growth (%)			
Sales revenue	(33.3)	17.1	21.3
EBIT	(87.0)	120.5	84.7
EPS	(87.0)	114.4	87.7
Margins (%)			
EBITDA	41.7	49.9	55.9
EBIT	10.0	18.9	28.8
Valuation (x)	**12/19A**	**12/20E**	**12/21E**
P/E	28.1	13.1	7.0
P/B	1.14	1.06	0.93
Dividend yield (%)	0.0	0.0	0.0
EV/sales	2.6	2.1	1.6
EV/EBITDA	6.1	4.2	2.9
EV/EBIT	25.5	11.2	5.7
ROE analysis (%)	**12/19A**	**12/20E**	**12/21E**
ROE	4.0	8.4	14.2
ROIC	4.5	8.0	14.5
Credit ratios	**12/19A**	**12/20E**	**12/21E**
Net debt/equity (%)	18.6	12.7	3.9
Net debt/EBITDA (x)	0.78	0.41	0.11

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

SK Hynix Inc. manufactures semiconductors, such as dynamic random access memory (DRAM) low-power mobile DRAMs, NAND flash memory for smartphones, tablet PCs and solid state drives (SSD), and static random access memory (SRAM chips).

Blue/Grey Sky Scenario



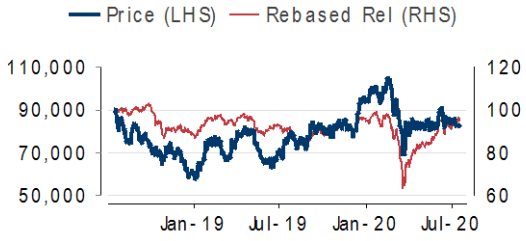
Our Blue Sky Scenario (W) **135,000**

Our blue sky scenario is based on (1) better-than-expected DRAM pricing into FY19; (2) faster-than-expected 72L 3D NAND qualification from enterprise SSDs client; (3) better-than-expected margin at NAND business and (4) better yield rates on 1x nm DRAM migration.

Our Grey Sky Scenario (W) **74,000**

Our blue sky scenario is based on (1) worse-than-expected DRAM pricing into FY19; (2) delay of 72L 3D NAND qualification from enterprise SSDs client; (3) yield rates penalties on 72L 3D NAND mass production (4) low productivity on 1x nm DRAM migration.

Share price performance



The price relative chart measures performance against the KOREA SE KOSPI IDX which closed at 2,201.19 on 17-Jul-2020

On 17-Jul-2020 the spot exchange rate was W1,203.44/US$1

CREDIT SUISSE

Switch, Inc.

High performance compute to drive a long tail of demand for SWCH facilities

Wireline

SWCH

Target price (12M, US$)
23.00
Outperform[V]

- **Beneficiary of high performance compute demand.** SWCH delivers immense power distributions to colocation customers above both global and North American average power capacities. It is capable of delivering power distribution of 55KW+ per cabinet to tenants due to its new and novel vintage builds, a figure higher than cloud data centres (on average), which are estimated to deliver ~40KW. We view that high power distribution will be in demand in the long-term as artificial intelligence, machine learning, and internet of things continue to necessitate computationally intensive tasks.
- **Robust campus and growing edge proposition.** One advantage unique to SWCH is its connectivity segment (20% of total revenues), in which the company created an ecosystem that allows its customers to buy telecom services as a cooperative. By bundling its customers together SWCH has reduced the overall cost for the services and passes those savings onto its customers. The company even guarantees 30% savings to its customers that participate in CORE Cooperative, SWCH's telecom community combined offering. Moreover, SWCH generally saves any given customer between 30% and 50% on their telecom expense, which is clearly a meaningful factor when enterprises are deciding between multiple data centre operators. SWCH is looking to become a leader in Class 4 edge computing, but physical security at edge facilities remains a key concern. Recently, SWCH has developed Switch Sentry to address the issue. Switch Sentry is a fully autonomous security robot backed with the reliability of 24/7 human in the loop monitoring, and as-needed piloting, built to enhance enterprise security systems.
- **Thesis.** We reiterate our OUTPERFORM rating on SWCH for the following reasons: It has shown strong signings recently, with over US$10mn of incremental annualised recurring revenue in 1Q20; its connectivity bundling can be a meaningful driver in winning business; and SWCH's new national sales team, an experienced group of industry experts, should help drive top-line growth outside of its Las Vegas campus.
- **Valuation: OUTPERFORM; target price of US$23.** Based on our SWCH DCF model, with a WACC of 6.4% (reflecting a 25% debt-to-capital ratio) and terminal growth of 2.0%, we arrive at a US$23 target price. Key risks include rev. concentration, share ownership control, dependency on future plans, and intellectual property protection ability.

Price (17 Jul 20, US$)	17.95
52-week price range	19.11 - 11.22
Market cap (US$ m)	4,337.01
Enterprise value (US$ m)	5,110

[V] = Stock Considered Volatile (see Disclosure Appendix)

Research Analysts

Sami Badri
212 538 1727
ahmedsami.badri@credit-suisse.com

George Engroff
212 325 2289
george.engroff@credit-suisse.com

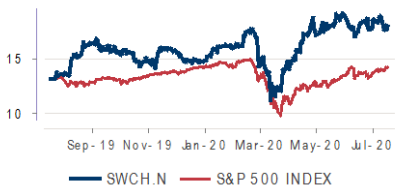
Lauren Lucas
212 325 4310
lauren.lucas@credit-suisse.com

Financial and valuation metrics

Year		12/19A	12/20E	12/21E
EPS (Excl. ESO) (US$)		0.13	0.15	0.28
EPS (CS adj.,)		0.13	0.15	0.28
Prev. EPS (CS adj., US$)		-	-	-
P/E (CS adj.) (x)		139.3	121.0	64.1
P/E rel. (CS adj., %)		714.5	478.8	329.1
Revenue (US$ m)		462.3	519.5	583.4
Net Debt (US$ m)		727	763	820
OCFPS (US$)		0.86	1.11	1.06
P/OCF (x)		21.0	16.1	17.0
Number of shares (m)	241.62	Price/Sales (x)		8.84
BV/share (Next Qtr., US$)	2.6	P/BVPS (x)		6.5
Net debt (Next Qtr., US$ m)	769.4	Dividend (current, US$)		-
Dividend yield (%)	-			

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$13.2

Quarterly EPS	Q1	Q2	Q3	Q4
2019A	0.01	0.02	0.03	0.05
2020E	-0.01	0.04	0.05	0.07
2021E	0.06	0.08	0.07	0.07

CREDIT SUISSE

Switch, Inc. (SWCH)

Price (17 Jul 2020): **US$17.95**

Target Price: **23.00**

Analyst: **Sami Badri**

Rating: **Outperform [V]**

Income Statement	12/19A	12/20E	12/21E
Revenue (US$ m)	**462.3**	**519.5**	**583.4**
EBITDA	**231.1**	**258.2**	**292.1**
Operating profit	**76.9**	**201.8**	**243.7**
Recurring profit	**34.3**	**38.7**	**71.9**
Cash Flow	**12/19A**	**12/20E**	**12/21E**
Cash flow from operations	**209**	**269**	**258**
CAPEX	(308)	(328)	(312)
Free cash flow to the firm	**(98)**	**(58)**	**(53)**
Cash flow from investments	**(309)**	**(328)**	**(312)**
Net share issue(/repurchase)	163	109	60
Dividends paid	0	0	0
Issuance (retirement) of debt	-	-	-
Other	(120)	(15)	(15)
Cash flow from financing activities	43	94	45
Effect of exchange rates	-	-	-
Changes in Net Cash/Debt	**(222)**	**(37)**	**(57)**
Net debt at end	727	763	820
Balance Sheet ($US)	**12/19A**	**12/20E**	**12/21E**
Assets			
Other current assets	11	13	14
Total current assets	**59**	**86**	**34**
Total assets	**1,774**	**1,995**	**2,113**
Liabilities			
Short-term debt	0	0	0
Total current liabilities	140	169	135
Long-term debt	745	814	814
Total liabilities	1,146	1,279	1,251
Shareholder equity	628	716	862
Total liabilities and equity	**1,774**	**1,995**	**2,113**
Net debt	727	763	820
Per share	**12/19A**	**12/20E**	**12/21E**
No. of shares (wtd avg)	245	242	244
CS adj. EPS	0.13	0.15	0.28
Prev. EPS (US$)	-	-	-
Dividend (US$)	0.00	0.00	0.00
Free cash flow per share	(0.40)	(0.24)	(0.22)
Earnings	**12/19A**	**12/20E**	**12/21E**
Sales growth (%)	13.9	12.4	12.3
Net profit growth (%)	7.6	13.9	90.2
EPS growth (%)	11.0	15.1	88.7
EBIT margin (%)	16.6	38.8	41.8
Valuation	**12/19A**	**12/20E**	**12/21E**
EV/Sales (x)	10.95	9.82	8.84
EV/EBIT (x)	65.8	25.3	21.2
P/E (x)	139.3	121.0	64.1

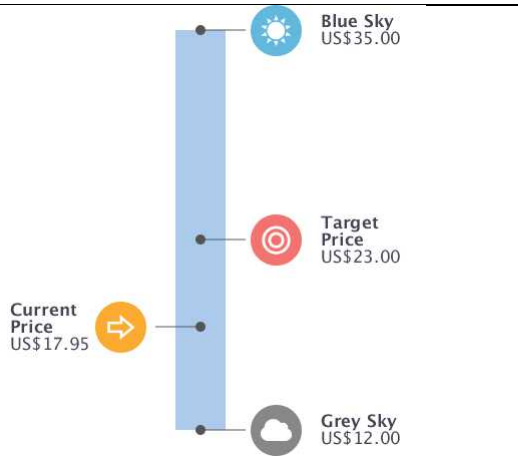
Quarterly EPS	Q1	Q2	Q3	Q4
2019A	0.01	0.02	0.03	0.05
2020E	-0.01	0.04	0.05	0.07
2021E	0.06	0.08	0.07	0.07

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Switch, Inc., based in Las Vegas, Nevada, is a technology communications infrastructure company offering colocation and connectivity services to globally interconnected entities that support the most innovative technology ecosystems.

Blue/Grey Sky Scenario



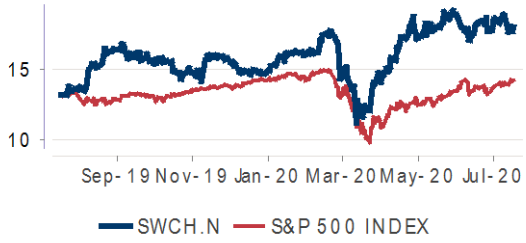
Our Blue Sky Scenario (US$) **35.00**

Our blue sky scenario of US$35 is computed from our discounted cash flow model with a WACC of 6.4% and a terminal growth rate of 4.15%.

Our Grey Sky Scenario (US$) **12.00**

Our grey sky scenario of US$12 is computed from our discounted cash flow model with a WACC of 6.4% and a terminal growth rate of 0.4%.

Share price performance



On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73
Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$13.2

CREDIT SUISSE

Taiwan Semiconductor Manufacturing

Data centre diversifies its exposure beyond smartphones

Semiconductor Devices

2330.TW

Target price (12M, NT$)
365.00

Neutral

- **High performance computing growing its importance.** TSMC's high performance computing business has more than doubled from US$6.1 bn in 2016 to US$12.6 bn in 2020E, growing at a 20% CAGR and is now the second-largest revenue driver at 30% of sales vs. 40-45% for smartphones. The company has a TAM expansion adding server chipsets adding AMD from GlobalFoundries and emerging China CPU makers, AI accelerators in FPGA, ASIC and GPU form, and 5G network processors and merchant data chipsets. The company benefitted from the surge in cryptocurrency demand in 2017-18 but the business has wound down since 2H18 when the Bitcoin pricing dropped.
- **Data centre/AI investment and China localisation support business acceleration.** TSMC should be the key beneficiary for the growing graphic and FPGA demand in data centre and AI computing with its technology leadership and capacity support. The growing requirement for AI training and inference should also support ASIC demand, with most of the semiconductor start-up developing AI chipsets working with TSMC on 16/12nm and 7nm for the company's front-end manufacturing and back-end packaging solutions.
- **Growth high in 2020E, but still expected to moderate in 2021.** We expect TSMC to still grow mid-teens YoY in 2020 supported by AMD ramps of server, PC and game console, Apple's build-up in 2H20, 5G from Mediatek and Qualcomm (still at TSMC in 2H for high-end and modem) and Huawei shipping through 3Q20. 2021 growth nets out to +6% YoY, factoring in early 2021 potential inventory adjustments along with the NVIDIA/Qualcomm shifts and Huawei impact offsetting continued drivers from other lead customers including HPC/AMD, Mediatek, Broadcom and Apple.
- **Maintain NEUTRAL with some offsetting headwinds in 2021.** We keep our 2020/21 EPS at NT$18.00/NT$18.15 and stay NEUTRAL with TP at NT$365 with milder growth, with offsets from Huawei, Qualcomm, NVIDIA and high semiconductor inventory. TSMC's longer-term industry position stays solid due to wide distance for its ecosystem and technology and drivers from 5G, high performance computing through AMD, AI accelerator, game console and Mac ramps, and from a low base in advanced auto and IoT.

Price (17 Jul 20, NT$)	367.00
Upside/downside (%)	-0.5
Mkt cap (NT$/US$ mn)	9,516,450 / 323,106
Enterprise value (NT$ mn)	9,041,315
Number of shares (mn)	25,930
Free float (%)	87.3
52-wk price range (NT$)	367-246
ADTO-6M (US$ mn)	555.1

Research Analysts

Randy Abrams, CFA
886 2 2715 6366
randy.abrams@credit-suisse.com

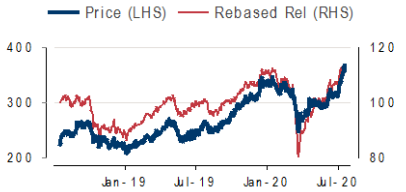
Haas Liu
886 2 2715 6365
haas.liu@credit-suisse.com

Financial and valuation metrics

Year	12/18A	12/19E	12/20E	12/21E
Revenue (NT$ mn)	1,031,474	1,069,985	1,262,856	1,304,942
EBITDA (NT$ mn)	676,170	659,543	835,353	899,449
EBIT (NT$ mn)	383,624	372,701	510,569	516,377
Net profit (NT$ mn)	351,187	345,317	466,741	471,840
EPS (CS adj.) (NT$)	13.54	13.32	18.0	18.2
Chg. from prev. EPS (%)	n.a.	0.0	0.0	0.0
Consensus EPS (NT$)	n.a.	13.32	17.56	18.79
EPS growth (%)	2.3	(1.7)	35.2	1.1
P/E (x)	27.1	27.6	20.4	20.2
Dividend yield (%)	2.2	2.7	2.7	3.0
EV/EBITDA (x)	13.3	13.8	10.8	9.8
P/B (x)	5.68	5.87	5.23	4.74
ROE (%)	22.0	20.9	27.1	24.7
Net debt/equity (%)	(30.7)	(25.2)	(29.1)	(36.3)

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17/07/20. On 17/07/20 the spot exchange rate was NT$29.45/US$1

Performance	1M	3M	12M
Absolute (%)	16.5	19.7	44.5
Relative (%)	10.9	4.8	31.7

Taiwan Semiconductor Manufacturing (2330.TW / 2330 TT)

Analyst: **Randy Abrams**

Price (17 Jul 2020): **NT$367.00** Target Price: **NT$365.00**

Rating: **Neutral**

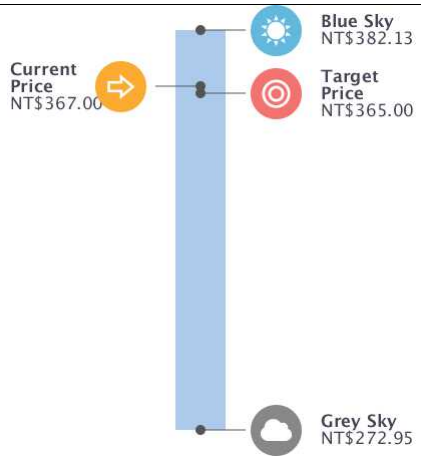
Income Statement (NT$ mn)	12/18A	12/19E	12/20E	12/21E
Sales revenue	**1,031,474**	**1,069,985**	**1,262,856**	**1,304,942**
Cost of goods sold	533,488	577,326	617,148	644,256
EBITDA	**676,170**	**659,543**	**835,353**	**899,449**
EBIT	**383,624**	**372,701**	**510,569**	**516,377**
Net interest expense/(inc.)	(11,643)	(12,940)	(11,504)	(14,205)
Recurring PBT	**397,510**	**389,803**	**528,364**	**536,182**
Profit after tax	**351,184**	**345,301**	**466,595**	**471,840**
Reported net profit	**351,187**	**345,317**	**466,741**	**471,840**
Net profit (Credit Suisse)	**351,187**	**345,317**	**466,741**	**471,840**
Balance Sheet (NT$ mn)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Cash & cash equivalents	695,182	583,448	705,040	903,921
Current receivables	129,198	139,771	134,314	160,836
Inventories	103,231	82,981	97,600	107,800
Other current assets	24,069	16,414	16,342	19,568
Current assets	**951,680**	**822,614**	**953,296**	**1,192,126**
Property, plant & equip.	1,072,050	1,352,377	1,352,377	1,352,377
Investments	29,305	30,172	22,917	22,917
Intangibles	17,002	18,094	18,094	18,094
Other non-current assets	20,091	41,548	41,548	41,548
Total assets	**2,090,128**	**2,264,805**	**2,388,232**	**2,627,062**
Current liabilities	**340,543**	**590,736**	**524,457**	**576,855**
Total liabilities	**412,632**	**642,710**	**567,884**	**620,108**
Total debt	180,555	175,422	175,422	175,422
Shareholders' equity	**1,676,818**	**1,621,410**	**1,819,512**	**2,006,118**
Minority interests	679	685	836	836
Total liabilities & equity	**2,090,128**	**2,264,805**	**2,388,232**	**2,627,062**
Cash Flow (NT$ mn)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
EBIT	**383,624**	**372,659**	**510,569**	**516,377**
Net interest	11,643	12,940	11,504	14,205
Tax paid	(46,326)	(44,502)	(61,769)	(64,342)
Working capital	(31,942)	15,525	(12,868)	(32,908)
Other cash & non-cash items	257,444	258,475	287,068	431,429
Operating cash flow	**574,443**	**615,097**	**734,504**	**864,761**
Capex	(315,582)	(458,802)	(492,588)	(410,415)
Free cash flow to the firm	**258,861**	**156,295**	**241,916**	**454,346**
Investing cash flow	**(314,269)**	**(457,181)**	**(483,618)**	**(418,531)**
Equity raised	0	0	0	0
Dividends paid	(207,443)	(259,304)	(259,304)	(285,234)
Financing cash flow	**(245,125)**	**(269,639)**	**(233,579)**	**(285,409)**
Total cash flow	**15,049**	**(111,724)**	**17,307**	**160,822**
Adjustments	9,862	(9,114)	(7,561)	0
Net change in cash	**24,911**	**(120,838)**	**9,746**	**160,822**
Per share	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Shares (wtd avg.) (mn)	25,930	25,930	25,930	25,930
EPS (Credit Suisse) (NT$)	**13.54**	**13.32**	**18.00**	**18.20**
DPS (NT$)	8.00	10.00	10.00	11.00
Operating CFPS (NT$)	22.15	23.72	28.33	33.35
Earnings	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Growth (%)				
Sales revenue	5.5	3.7	18.0	3.3
EBIT	(0.5)	(2.8)	37.0	1.1
EPS	2.3	(1.7)	35.2	1.1
Margins (%)				
EBITDA	65.6	61.6	66.1	68.9
EBIT	37.2	34.8	40.4	39.6
Valuation (x)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
P/E	27.1	27.6	20.4	20.2
P/B	5.68	5.87	5.23	4.74
Dividend yield (%)	2.2	2.7	2.7	3.0
EV/sales	8.7	8.5	7.1	6.7
EV/EBITDA	13.3	13.8	10.8	9.8
EV/EBIT	23.5	24.4	17.6	17.0
ROE analysis (%)	**12/18A**	**12/19E**	**12/20E**	**12/21E**
ROE	22.0	20.9	27.1	24.7
ROIC	30.1	27.8	36.0	35.4
Credit ratios	**12/18A**	**12/19E**	**12/20E**	**12/21E**
Net debt/equity (%)	(30.7)	(25.2)	(29.1)	(36.3)
Net debt/EBITDA (x)	(0.76)	(0.62)	(0.63)	(0.81)

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Taiwan Semiconductor Manufacturing Co., Ltd. is principally engaged in the research, development, manufacture and distribution of integrated circuit (IC) related products. The company operates its businesses through wafer manufacture, mask production.

Blue/Grey Sky Scenario



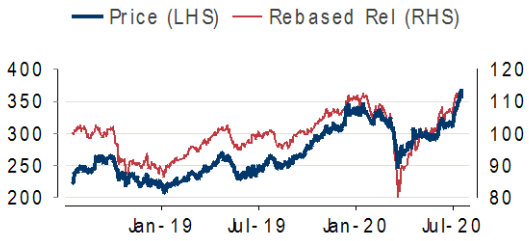
Our Blue Sky Scenario (NT$) **382.13**

Our blue sky scenario valuation of NT$382 for TSMC is based on its continued leading position in advanced nodes and specialty technology. TSMC could thus maintain high market share and structural profitability.

Our Grey Sky Scenario (NT$) **272.95**

Our grey sky valuation scenario of NT$273 for TSMC assumes the company is facing more competition in advanced nodes from Samsung and Intel internal and thus cannot maintain its pricing power and profitability.

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17-Jul-2020

On 17-Jul-2020 the spot exchange rate was NT$29.45/US$1

CREDIT SUISSE

TongFu

Growing with AMD's share gains and China CPU emergence, but fair valuation

002156.SZ

Target price (12M, Rmb)
30.10
Neutral[V]

Semiconductor Devices

- **Beneficiary of AMD's share gain.** Tongfu has ~50% revenue from Tongfu-AMD JV factories which have over 95% revenue from AMD's CPU and GPU. Although Tongfu's share allocation within AMD has fallen over the past year with AMD migration from 14nm to 7nm, Tongfu still has nearly half allocation for AMD's 7nm processors. Besides AMD, Tongfu is also working with China CPU developers for OSAT for China CPU as it has better CPU/GPU OSAT experience than other China peers. So emerging China CPU demand will fuel the Tongfu-AMD JV growth on top of solid demand from AMD. We expect the Tongfu-AMD JV to grow revenue at 21% CAGR in 2020-22.
- **Growing China fabless besides MediaTek's share gain.** The other half of the business is benefitting from fast-growth China fabless customers and, more recently, MediaTek's smartphone processor share gain within Huawei. MediaTek contributes about 10-20% revenue for original Tongfu. Further, Tongfu continues to grow revenues with China fabless customers in the areas of RF, power, mobile, automotive industrial and base station. The next meaningful driver is China's DRAM and Tongfu is one of the major OSAT partners for China's DRAM company. We expect the original Tongfu to grow revenue at 18% CAGR in 2020-22.
- **Margin expansion driven by revenue growth and opex control.** We expect Tongfu's operating margin to expand from 0.4% in 2019 to 6.7% in 2022, as a result of improving GM as well as disciplined opex. The GM expansion comes from continued high utilisation, better production efficiency as well as better customer pricing.
- **NEUTRAL due to fair valuation.** While we like Tongfu for its multiple growth drivers across server, mobile and China, the valuation doesnot look attractive when comparing with global OSAT peers with Tongfu's share trading at 4.9x on consensus 2021 BPS with 9% ROE. Our TP of Rmb30.1 is based on 3.6x 2021 BPS. The 3.6x multiple is at its +1.0 STDEV of historical P/B on consensus forward 12M BPS. Rated Neutral. **Upside risks:** A-share semi/tech rally, even better AMD/MediaTek share gain in server/smartphone, faster China CPU/DRAM development and better GM expansion. **Downside risks:** Weaker server demand, weaker AMD/MediaTek demand on an even longer pandemic, slower-than-expected China CPU/DRAM development and slower GM expansion on steeper capacity build.

Price (20 Jul 20, Rmb)	26.19
Upside/downside (%)	14.9
Mkt cap (Rmb/US$ mn)	30,216 / 4,324
Enterprise value (Rmb mn)	32,252
Number of shares (mn)	1,154
Free float (%)	68.2
52-wk price range (Rmb)	33.30-8.05
ADTO-6M (US$ mn)	242.4

[V] = Stock Considered Volatile (see Disclosure Appendix)

Research Analysts

Chaolien Tseng
852 2101 6795
chaolien.tseng@credit-suisse.com

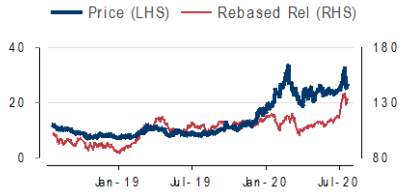
Kyna Wong
852 2101 6950
kyna.wong@credit-suisse.com

Financial and valuation metrics

Year	12/19A	12/20E	12/21E	12/22E
Revenue (Rmb mn)	8,266.6	10,297.3	12,109.8	14,134.7
EBITDA (Rmb mn)	1,256.7	1,841.4	2,258.8	2,678.2
EBIT (Rmb mn)	33.7	487.2	721.5	949.2
Net profit (Rmb mn)	19.1	347.7	546.0	762.0
EPS (CS adj.) (Rmb)	0.02	0.29	0.41	0.57
Chg. from prev. EPS (%)	n.a.	0.0	0.0	0.0
Consensus EPS (Rmb)	n.a.	0.27	0.45	0.67
EPS growth (%)	(84.9)	1,659.2	39.5	39.6
P/E (x)	1,578.5	89.7	64.3	46.1
Dividend yield (%)	0.0	0.4	0.6	0.8
EV/EBITDA (x)	26.9	16.8	14.1	12.1
P/B (x)	5.05	3.36	3.17	2.95
ROE (%)	0.3	4.2	5.1	6.6
Net debt/equity (%)	55.0	7.2	14.2	16.7

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the Shanghai Shenzhen CSI300 index which closed at 4,680.30 on 20/07/20. On 20/07/20 the spot exchange rate was Rmb6.99/US$1

Performance	1M	3M	12M
Absolute (%)	11.3	9.8	217.8
Relative (%)	(2.9)	(13.1)	194.9

TongFu (002156.SZ / 002156 CH)

Price (20 Jul 2020): **Rmb26.19**

Target Price: **Rmb30.10**

Analyst: **Chaolien Tseng**

Rating: **Neutral [V]**

Income Statement (Rmb mn)	12/19A	12/20E	12/21E	12/22E
Sales revenue	**8,267**	**10,297**	**12,110**	**14,135**
Cost of goods sold	7,136	8,638	10,029	11,565
EBITDA	**1,257**	**1,841**	**2,259**	**2,678**
EBIT	**34**	**487**	**722**	**949**
Net interest expense/(inc.)	198	278	215	182
Recurring PBT	**(14)**	**364**	**660**	**921**
Profit after tax	**37**	**372**	**620**	**866**
Reported net profit	**19**	**348**	**546**	**762**
Net profit (Credit Suisse)	**19**	**348**	**546**	**762**
Balance Sheet (Rmb mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Cash & cash equivalents	2,225	5,790	2,913	2,471
Current receivables	1,697	2,655	3,004	3,395
Inventories	1,894	2,087	2,556	2,992
Other current assets	245	277	279	279
Current assets	**6,061**	**10,809**	**8,752**	**9,138**
Property, plant & equip.	7,439	8,203	9,356	10,323
Investments	161	161	161	161
Intangibles	272	268	268	268
Other non-current assets	2,225	2,747	2,755	2,755
Total assets	**16,157**	**22,188**	**21,293**	**22,645**
Current liabilities	**7,253**	**8,036**	**6,433**	**6,871**
Total liabilities	**9,655**	**11,172**	**9,569**	**10,007**
Total debt	5,799	6,578	4,578	4,578
Shareholders' equity	**5,977**	**10,454**	**11,087**	**11,898**
Minority interests	391	429	503	607
Total liabilities & equity	**16,157**	**22,188**	**21,293**	**22,645**
Cash Flow (Rmb mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
EBIT	**34**	**487**	**722**	**949**
Net interest	0	0	0	0
Tax paid	0	0	0	0
Working capital	(298)	(421)	(423)	(390)
Other cash & non-cash items	1,680	1,683	1,626	1,804
Operating cash flow	**1,415**	**1,750**	**1,924**	**2,363**
Capex	(2,109)	(2,843)	(2,665)	(2,670)
Free cash flow to the firm	**(694)**	**(1,093)**	**(742)**	**(307)**
Investing cash flow	**(2,180)**	**(2,874)**	**(2,665)**	**(2,670)**
Equity raised	0	4,000	0	0
Dividends paid	(224)	(87)	(135)	(135)
Financing cash flow	**1,608**	**4,662**	**(2,135)**	**(135)**
Total cash flow	**843**	**3,539**	**(2,877)**	**(442)**
Adjustments	9	26	0	0
Net change in cash	**852**	**3,565**	**(2,877)**	**(442)**
Per share	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Shares (wtd avg.) (mn)	1,154	1,191	1,341	1,341
EPS (Credit Suisse) (Rmb)	**0.02**	**0.29**	**0.41**	**0.57**
DPS (Rmb)	0.00	0.10	0.16	0.22
Operating CFPS (Rmb)	1.23	1.47	1.43	1.76
Earnings	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Growth (%)				
Sales revenue	14.5	24.6	17.6	16.7
EBIT	(82.9)	1346.3	48.1	31.5
EPS	(84.9)	1659.2	39.5	39.6
Margins (%)				
EBITDA	15.2	17.9	18.7	18.9
EBIT	0.4	4.7	6.0	6.7
Valuation (x)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
P/E	1578.5	89.7	64.3	46.1
P/B	5.05	3.36	3.17	2.95
Dividend yield (%)	0.0	0.4	0.6	0.8
EV/sales	4.1	3.0	2.6	2.3
EV/EBITDA	26.9	16.8	14.1	12.1
EV/EBIT	1003.2	63.6	44.2	34.1
ROE analysis (%)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
ROE	0.3	4.2	5.1	6.6
ROIC	(1.0)	4.6	5.4	6.3
Credit ratios	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Net debt/equity (%)	55.0	7.2	14.2	16.7
Net debt/EBITDA (x)	2.84	0.43	0.74	0.79

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Headquartered in Nantong, Jiangsu Province, TFME is a leading OSAT company in China. Established in 1997 and listed in 2007, it offers various products including WLCSP,BGA and Bumping, etc, 70% of which are overseas sales.

Blue/Grey Sky Scenario

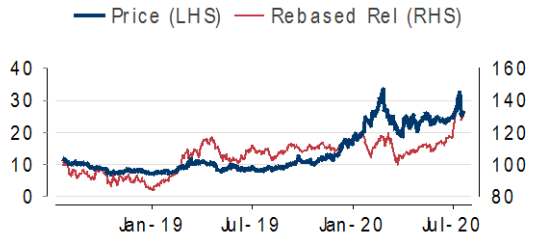
Our Blue Sky Scenario (Rmb) **39.20**

Our blue sky scenario of Rmb39.2 assumes that the company enjoys better-than-expected revenue/margin growth from AMD's substantial share gains in CPU/GPU as well as providing more advanced packaging/testing services at high yields to AMD's advanced processors.

Our Grey Sky Scenario (Rmb) **21.10**

Our grey sky scenario of Rmb21.1 assumes that the company suffers even lower utilization for both AMD and non-AMD businesses due to worsening global economy and intensified pricing competition with Chinese and worldwide peers during the downturn. Further, its advanced technologies to AMD may experience lower-than-expected yields.

Share price performance



The price relative chart measures performance against the Shanghai Shenzhen CSI300 index which closed at 4,680.30 on 20-Jul-2020

On 20-Jul-2020 the spot exchange rate was Rmb6.99/US$1

CREDIT SUISSE

Wiwynn Corporation

A unique jewel in the crown

6669.TW

Target price (12M, NT$)
960.00

Outperform[V]

IT Hardware

- **Initiate coverage with OUTPERFORM and TP of NT$960.** Wiwynn is a leading open-sourced cloud IT infrastructure ODM, having unique positioning with the two major global hyperscalers (Facebook/Microsoft). Its sales surged by 1x CAGR from 2016 to 2018 driven by cloud IT infrastructure ramps, but declined nearly 10% YoY in 2019 due to memory pricing correction, although its total server volumes continued to grow. We believe Wiwynn, as a pure play cloud IT infrastructure ODM, will see the best leverage from increasing workload shift to cloud, along with further ODM Direct proliferation, as we forecast over +30% CAGR in earnings from 2019-22E. Our TP of NT$960 (over 20% upside) is based on 15x 2021E P/E, 0.5SD above its average since the Mainboard listing.
- **Healthy cloud outlook despite COVID-19.** We believe Wiwynn's near-term outlook remains healthy, despite the prolonging impact from COVID-19, and the subsequent supply chain and logistics bottleneck, as its key hyperscale customers work to secure enough local capacities in meeting the surging demand from work-from-home and distance education. Along with the ramp of the third hyperscaler in the US (Amazon) starting from May-2020, we believe it could potentially lead to more upsides in the near term.
- **Readying for second-wave of transformation.** Aside from capitalising the opportunities in cloud, we also believe Wiwynn is set for a second-wave of transformation along with the 5G take-off, having already introduced a new product line-up the past year including all-in-one 3U system (EP100 on Intel; EP120 on ARM); ES200 for short-depth servers; and SV302G3 for AI. We expect the business to officially take-off from 2021, driving better profitability on more value-add offerings. We also believe the market has failed to quantify the opportunities from the new business, leaving ample room for further upgrade.
- **OUTPERFORM.** Wiwynn trades at 17x/12x/9x our 2020/2021/22E, vs its historical average of 14x since the Mainboard listing in March-2019, and YTD average of 16x P/E, in a range of 9-19x. We believe the stock will further advance as a leading pure-play cloud IT infrastructure ODM, taking advantage of the long-term trend from increasing data workflow shift to cloud, and new edge opportunities taking- off from 2021. **Key risks:** (1) capex spending pushed off by key customers due to shelter-in-place orders amid the COVID-19 pandemic; (2) volatility in key components pricing leading to lower margins; and (3) lock-down of manufacturing sites for virus containment.

Price (17 Jul 20, NT$)	753.00
Upside/downside (%)	27.5
Mkt cap (NT$/US$ mn)	131,655 / 4,470
Enterprise value (NT$ mn)	127,933
Number of shares (mn)	174.84
Free float (%)	57.0
52-wk price range (NT$)	873-355
ADTO-6M (US$ mn)	47.4

[V] = Stock Considered Volatile (see Disclosure Appendix)

Research Analysts

Harvie Chou
886 2 2715 6364
harvie.chou@credit-suisse.com

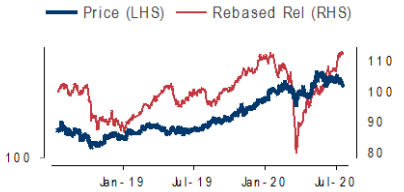
Jerry Su
886 2 2715 6361
jerry.su@credit-suisse.com

Financial and valuation metrics

Year	12/19A	12/20E	12/21E	12/22E
Revenue (NT$ mn)	163,600	199,114	251,610	314,904
EBITDA (NT$ mn)	8,370.0	11,289.7	15,008.1	20,183.7
EBIT (NT$ mn)	8,160.1	10,851.8	14,188.9	18,964.5
Net profit (NT$ mn)	6,169.3	8,564.6	11,149.9	14,919.7
EPS (CS adj.) (NT$)	37.06	43.2	63.77	85.34
Chg. from prev. EPS (%)	n.a	n.a	n.a	n.a
Consensus EPS (NT$)	n.a.	43.8	53.59	67.69
EPS growth (%)	(2.1)	16.6	47.6	33.8
P/E (x)	20.3	17.4	11.8	8.8
Dividend yield (%)	3.1	3.9	5.1	6.8
EV/EBITDA (x)	15.3	11.3	8.4	6.1
P/B (x)	6.52	5.31	4.28	3.37
ROE (%)	40.1	38.1	40.1	42.7
Net debt/equity (%)	(16.6)	(16.2)	(17.4)	(22.3)

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17/07/20. On 17/07/20 the spot exchange rate was NT$29.45/US$1

Performance	1M	3M	12M
Absolute (%)	(7.6)	13.6	108.9
Relative (%)	(13.2)	(1.4)	96.1

Wiwynn Corporation (6669.TW / 6669 TT)

Price (17 Jul 2020): **NT$753.00** Target Price: **NT$960.00**

Analyst: **Harvie Chou**
Rating: **Outperform**

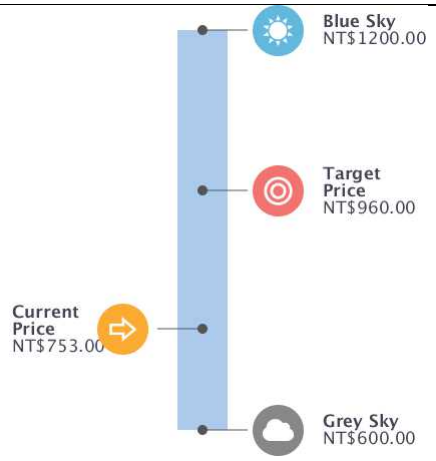
Income Statement (NT$ mn)	12/19A	12/20E	12/21E	12/22E
Sales revenue	**163,600**	**199,114**	**251,610**	**314,904**
Cost of goods sold	152,252	184,505	233,290	291,154
EBITDA	**8,370**	**11,290**	**15,008**	**20,184**
EBIT	**8,160**	**10,852**	**14,189**	**18,964**
Net interest expense/(inc.)	251	411	418	408
Recurring PBT	**7,758**	**10,712**	**13,937**	**18,650**
Profit after tax	**6,169**	**8,565**	**11,150**	**14,920**
Reported net profit	**6,169**	**8,565**	**11,150**	**14,920**
Net profit (Credit Suisse)	**6,169**	**8,565**	**11,150**	**14,920**
Balance Sheet (NT$ mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Cash & cash equivalents	11,992	13,680	15,009	18,371
Current receivables	16,847	15,515	17,986	21,171
Inventories	17,442	23,332	30,431	38,763
Other current assets	133	3,020	3,501	4,800
Current assets	**46,413**	**55,547**	**66,927**	**83,105**
Property, plant & equip.	718	1,264	1,656	1,647
Investments	0	0	0	0
Intangibles	19	0	0	0
Other non-current assets	997	983	983	983
Total assets	**48,147**	**57,795**	**69,567**	**85,736**
Current liabilities	**27,532**	**32,656**	**38,417**	**46,356**
Total liabilities	**27,928**	**33,014**	**38,774**	**46,713**
Total debt	8,638	9,658	9,658	9,658
Shareholders' equity	**20,165**	**24,782**	**30,793**	**39,022**
Minority interests	0	0	0	0
Total liabilities & equity	**48,147**	**57,795**	**69,567**	**85,736**
Cash Flow (NT$ mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
EBIT	**8,160**	**10,852**	**14,189**	**18,964**
Net interest	0	0	0	0
Tax paid	0	0	0	0
Working capital	1,781	(3,342)	(4,290)	(4,877)
Other cash & non-cash items	(1,781)	(1,849)	(2,220)	(2,826)
Operating cash flow	**8,160**	**5,661**	**7,679**	**11,262**
Capex	(747)	(973)	(1,200)	(1,200)
Free cash flow to the firm	**7,413**	**4,687**	**6,479**	**10,062**
Investing cash flow	**(2,816)**	**(2,898)**	**(3,611)**	**(3,611)**
Equity raised	226	2	0	0
Dividends paid	(2,432)	(4,017)	(5,139)	(6,690)
Financing cash flow	**957**	**1,961**	**0**	**0**
Total cash flow	**6,301**	**4,723**	**4,068**	**7,651**
Adjustments	0	0	0	0
Net change in cash	**6,301**	**4,723**	**4,068**	**7,651**
Per share	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Shares (wtd avg.) (mn)	166	198	175	175
EPS (Credit Suisse) (NT$)	**37.06**	**43.20**	**63.77**	**85.34**
DPS (NT$)	23.00	29.39	38.26	51.20
Operating CFPS (NT$)	49.02	28.55	43.92	64.42
Earnings	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Growth (%)				
Sales revenue	(9.6)	21.7	26.4	25.2
EBIT	14.9	33.0	30.8	33.7
EPS	(2.1)	16.6	47.6	33.8
Margins (%)				
EBITDA	5.1	5.7	6.0	6.4
EBIT	5.0	5.5	5.6	6.0
Valuation (x)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
P/E	20.3	17.4	11.8	8.8
P/B	6.52	5.31	4.28	3.37
Dividend yield (%)	3.1	3.9	5.1	6.8
EV/sales	0.8	0.6	0.5	0.4
EV/EBITDA	15.3	11.3	8.4	6.1
EV/EBIT	15.7	11.8	8.9	6.5
ROE analysis (%)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
ROE	40.1	38.1	40.1	42.7
ROIC	37.4	46.1	49.1	54.4
Credit ratios	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Net debt/equity (%)	(16.6)	(16.2)	(17.4)	(22.3)
Net debt/EBITDA (x)	(0.40)	(0.36)	(0.36)	(0.43)

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Founded in 2012, Wiwynn is the globally leading open-sourced cloud IT infrastructure ODM established under Wistron Corporation, targeting to provide increasing optimised workload IT solutions to cloud operators with the best total cost of ownership.

Blue/Grey Sky Scenario



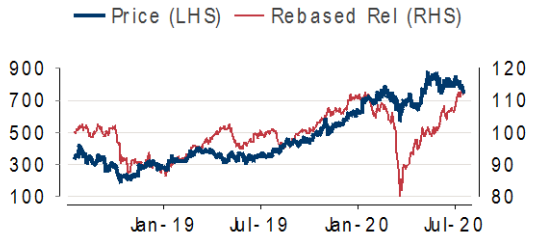
Our Blue Sky Scenario (NT$) **1,200**

Our blue sky scenario assumes NT$1,200 target price based on the peak multiple of 19x 2021E P/E, factoring in a better sales growth as a result of accelerating capital expenditure spending by its top-two customers, while it also sees faster ramp of new hyperscale client.

Our Grey Sky Scenario (NT$) **600.00**

Our grey sky scenario assumes NT$600 target price based on the trough multiple of 9x 2021E P/E, factoring in a slower sales growth due to capital expenditure outlook cut by its two key customers due to weaker macro amid COVID-19. We also assume slower ramp of its new hyperscale client.

Share price performance



The price relative chart measures performance against the TAIWAN SE WEIGHTED INDEX which closed at 12,181.56 on 17-Jul-2020
On 17-Jul-2020 the spot exchange rate was NT$29.45/US$1

CREDIT SUISSE

Xilinx

Solid core with DCG growth optionality

XLNX

Target price (12M, US$)
100.00

Outperform

Semiconductor Devices

- **LT increasing leverage to datacentre.** XLNX is ramping up its efforts with key data centre customers, ecosystem partners and software application developers, to further enable innovation and deployments in compute acceleration, computational storage and network acceleration. Its DCG group made up ~7% of rev in FY19, which we see increasing to ~9%/14% by FY20/21.
- **Datacentre growth starting to materialise.** While DCG is still only ~7% of rev, we expect growth to reaccelerate to 80% YoY by F4Q20 with strong momentum at hyperscalers where XLNX is expanding its ecosystem across compute, storage and networking segments. We continue to see XLNX as well positioned to benefit from 5G infrastructure build-outs and more importantly to an accelerating compute TAM driven by AI and data analytics. While investors are hyper-focused on architectural/share shifts, we continue to stress that AI is first and foremost a "rising tide"—we see AI adding ~$430 bn of incremental Semi TAM and ~$130 bn of compute TAM beneficial to CPUs, GPUs, FPGAs and ASICs. We would note that Wireless rev of $200 mn in F1Q was already ~30% above the prior Wireless peak in 2014 even as we are still very early innings.
- **Outlook for CY2020/21.** Post a 6/29 positive pre, we raised our FY21 rev/EPS to US$2.93 bn/US$2.68 from US$2.86 bn/US$2.56 and we maintain our FY22 rev/EPS at US$3.15 bn/US$3.23. Specifically in DCG we see FY20/21 +22%/51% YoY growth.
- **Valuation.** While XLNX's positive pre-announcement will likely intensify concerns that near-term semi strength is inventory build/pull-ins due to COVID-19 and US/China uncertainties, we continue to see a multi-quarter tailwind as supply chain has likely become more redundant, more sovereign, more automated and more intelligent in a post-COVID-19 world, in addition to a secular transfer of value from traditional industries into silicon driven by an increasingly data driven economy. XLNX is currently trading at 34.0x/29.7x CY20/CY21 EPS, or 33.3x our annualised trough EPS of $0.68, and 27.6x our CY21 EPS. We'd note risks include: (1) continued COVID-19 uncertainty, (2) Huawei ban, and (3) comparatively slower ramp in DCG/RF-SoC, though we remain positive on secular tailwinds (AI, ML, 5G) driving XLNX's growth, as the Compute TAM accelerates.

Price (17 Jul 20, US$)	100.49
52-week price range	132.14 - 68.98
Market cap (US$ m)	24,438.60
Enterprise value (US$ m)	24,452

Research Analysts

John W. Pitzer
212 538 4610
john.pitzer@credit-suisse.com

Dalya Hahn
212 325 7843
dalya.hahn@credit-suisse.com

Eric Hu
212 325 4735
eric.hu@credit-suisse.com

Jerome Darling
212 325 3211
jerome.darling@credit-suisse.com

Financial and valuation metrics

Year	3/19A	3/20E	3/21E	3/22E
EPS (Excl. ESO) (US$)	3.49	3.31	2.68	3.23
EPS (CS adj.,)	3.49	3.31	2.68	3.23
Prev. EPS (CS adj., US$)	-	-	-	-
P/E (CS adj.) (x)	28.8	30.4	37.6	31.1
P/E rel. (CS adj., %)	147.8	120.3	192.8	186.8
Revenue (US$ m)	3,059.0	3,162.7	2,934.0	3,150.0
Net Debt (US$ m)	550	14	-547	1,246
OCFPS (US$)	4.41	4.91	3.77	4.31
P/OCF (x)	22.8	20.5	26.7	23.3
Number of shares (m)	243.19	Price/Sales (x)		8.19
BV/share (Next Qtr., US$)	10.5	P/BVPS (x)		10.0
Net debt (Next Qtr., US$ m)	233.6	Dividend (current, US$)		-
Dividend yield (%)	-			

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance

On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$122.7

Quarterly EPS	Q1	Q2	Q3	Q4
2019A	0.74	0.84	0.93	0.95
2020E	0.95	0.91	0.65	0.76
2021E	0.60	0.63	0.65	0.75

Xilinx (XLNX)

Price (17 Jul 2020): **US$100.49** Target Price: **100.00**

Analyst: **John Pitzer**
Rating: **Outperform**

Income Statement	3/19A	3/20E	3/21E	3/22E
Revenue (US$ m)	**3,059.0**	**3,162.7**	**2,934.0**	**3,150.0**
EBITDA	**961.7**	**853.7**	**767.2**	**892.5**
Operating profit	**961.7**	**853.7**	**767.2**	**892.5**
Recurring profit	**973.3**	**895.7**	**735.2**	**864.5**
Cash Flow	**3/19A**	**3/20E**	**3/21E**	**3/22E**
Cash flow from operations	**1,132**	**1,245**	**933**	**1,062**
CAPEX	(89)	(129)	0	0
Free cash flow to the firm	**1,043**	**1,116**	**933**	**1,062**
Cash flow from investments	**(620)**	**(129)**	**0**	**0**
Net share issue(/repurchase)	(143)	(242)	0	0
Dividends paid	(364)	(370)	(372)	(372)
Issuance (retirement) of debt	0	0	0	0
Other	(46)	0	0	0
Cash flow from financing activities	(553)	(612)	(372)	(372)
Effect of exchange rates	0	0	0	0
Changes in Net Cash/Debt	**220**	**536**	**561**	**(1,793)**
Net debt at end	550	14	(547)	1,246
Balance Sheet ($US)	**3/19A**	**3/20E**	**3/21E**	**3/22E**
Assets				
Other current assets	2,556	1,099	1,099	1,099
Total current assets	**3,892**	**2,909**	**3,476**	**1,690**
Total assets	**5,151**	**4,693**	**5,182**	**3,366**
Liabilities				
Short-term debt	0	0	0	0
Total current liabilities	475	1,086	989	996
Long-term debt	1,235	747	747	747
Total liabilities	2,290	2,378	2,282	2,288
Shareholder equity	2,862	2,315	2,900	1,078
Total liabilities and equity	**5,151**	**4,693**	**5,182**	**3,366**
Net debt	550	14	(547)	1,246
Per share	**3/19A**	**3/20E**	**3/21E**	**3/22E**
No. of shares (wtd avg)	257	254	247	247
CS adj. EPS	3.49	3.31	2.68	3.23
Prev. EPS (US$)	-	-	-	-
Dividend (US$)	0.00	0.00	0.00	0.00
Free cash flow per share	4.07	4.40	3.77	4.31
Earnings	**3/19A**	**3/20E**	**3/21E**	**3/22E**
Sales growth (%)	24.0	3.4	(7.2)	7.4
Net profit growth (%)	79.1	(6.2)	(21.1)	20.1
EPS growth (%)	80.1	(5.2)	(19.1)	20.6
EBIT margin (%)	31.4	27.0	26.1	28.3
Valuation	**3/19A**	**3/20E**	**3/21E**	**3/22E**
EV/Sales (x)	8.17	7.73	8.14	8.15
EV/EBIT (x)	26.0	28.6	31.1	28.8
P/E (x)	28.8	30.4	37.6	31.1
Quarterly EPS	**Q1**	**Q2**	**Q3**	**Q4**
2019A	0.74	0.84	0.93	0.95
2020E	0.95	0.91	0.65	0.76
2021E	0.60	0.63	0.65	0.75

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

Xilinx, Inc. (Xilinx) designs, develops and markets programmable platforms. These programmable platforms have components, which include integrated circuits (ICs) in the form of programmable logic devices (PLDs)

Blue/Grey Sky Scenario

Our Blue Sky Scenario (US$) **150.00**

In our blue sky scenario, XLNX (1) gains PLD share from INTC/ALTR, (2) achieves out-sized AWS traction, and (3) drives OpM leverage through a tightly managed opex budget. High-double digit rev growth, operating leverage, and multiple expansion drive our blue-sky value of US$150. Our blue sky valuation is 47.3x CY21 EPS.

Our Grey Sky Scenario (US$) **80.00**

In our grey sky scenario, XLNX (1) cedes PLD share due to competitive pricing pressures from INTC/ALTR, (2) struggles to address AMZN's requirements and loses design wins, and (3) continues to struggle to manage opex. Our grey sky of US$80 assumes mid-single digit rev growth, no OpM leverage, and a stable multiple. Our grey sky valuation is 25.2x CY21 EPS.

Share price performance

On 17-Jul-2020 the S&P 500 INDEX closed at 3224.73
Daily Jul19, 2019 - Jul17, 2020, 07/19/19 = US$122.7

CREDIT SUISSE

21Vianet Group

A strategic shift in the right direction

VNET

Target price (12M, US$)
25.00

Outperform[V]

Integrated Telecommunication Services

- 21 Vianet (VNET) is a carrier-neutral data centre provider in China, with circa 5.0% market share. Having divested from loss-making bandwidth reselling and fixed broadband services, VNET is now more focused on the construction of data centres, as well as VPN services and cloud services. Furthermore, it is now offering 'wholesale' data centre services to hyperscale customers such as Alibaba, as opposed to its traditional focus on the 'retail' space. On 22 June 2020, VNET issued US$150 mn in convertible bonds (carrying a 4.5% coupon and a strike of US$17 per ADS), to a Blackstone private equity fund, which enters as a new strategic investor.
- While there is some risk on execution, our expectation is that VNET will seek to deploy this capital in value-accretive wholesale datacentre projects. We currently forecast that VNET will enjoy a 26.0% three-year revenue CAGR across FY19-22. We also forecast an increase in margins as VNET enjoys some operational gearing over centralised costs, leading us to forecast a 31.2% three-year CAGR in adjusted EBITDA.
- However, we acknowledge that data centre construction is capital intensive, and so we expect VNET to remain cash flow negative until FY24 and loss-making until FY23.
- To factor in both the strong structural growth and heavy capital expenditure, we use discounted cash flow (DCF) as our primary valuation methodology, deriving a target price of US$25 per ADS. VNET has enjoyed an extremely powerful share price rally YTD, as investors have welcomed the shift in strategy towards wholesale data centre provision; this is expected to allow VNET to enjoy structural growth given the trends of work from home and increasing data use. Indeed, the share price has almost reached our DCF-based target price. We maintain our OUTPERFORM rating but await revised rollout guidance—expected in the 2Q20 results briefing scheduled for late August.

Price (17 Jul 20, US$)	24.11
Upside/downside (%)	3.7
Mkt cap (US$mn)	2,723
Enterprise value (Rmb mn)	24,209
Number of shares (mn)	112.95
Free float (%)	45.9
52-wk price range (US$)	29.25-6.41
ADTO-6M (US$ mn)	8.2

[V] = Stock Considered Volatile (see Disclosure Appendix)

Research Analysts

Colin McCallum, CA
852 2101 6514
colin.mccallum@credit-suisse.com

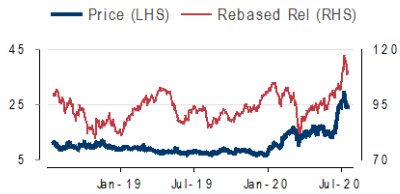
Billy Lee
852 2101 6529
billy.lee@credit-suisse.com

Financial and valuation metrics

Year	12/19A	12/20E	12/21E	12/22E
Revenue (Rmb mn)	3,789.0	4,629.4	5,959.3	7,571.2
EBITDA (Rmb mn)	954.4	1,152.0	1,624.4	2,213.6
EBIT (Rmb mn)	182.2	346.5	570.6	842.9
Net profit (Rmb mn)	(182.3)	(127.4)	(143.1)	(53.9)
EPS (CS adj.) (Rmb)	(1.62)	(1.14)	(1.28)	(0.48)
Chg. from prev. EPS (%)	n.a.	0.0	0.0	0.0
Consensus EPS (Rmb)	n.a.	(0.44)	1.3	2.51
EPS growth (%)	n.m.	n.m.	n.m.	n.m.
P/E (x)	n.m.	n.m.	n.m.	n.m.
Dividend yield (%)	0.0	0.0	0.0	0.0
EV/EBITDA (x)	24.0	21.9	17.3	13.8
P/B (x)	3.54	3.63	3.73	3.77
ROE (%)	(3.4)	(2.4)	(2.8)	(1.1)
Net debt/equity (%)	74.2	121.8	181.5	234.1

Source: Company data, Refinitiv, Credit Suisse estimates

Share price performance



The price relative chart measures performance against the MSCI CHINA F IDX which closed at 9,617.98 on 17/07/20. On 17/07/20 the spot exchange rate was US$1/US$1

Performance	1M	3M	12M
Absolute (%)	41.9	56.5	238.6
Relative (%)	33.3	39.5	219.6

CREDIT SUISSE

21Vianet Group (VNET.OQ / VNET US)

Analyst: **Colin McCallum**

Price (17 Jul 2020): **US$24.11**

Target Price: **US$25.00**

Rating: **Outperform [V]**

Income Statement (Rmb mn)	12/19A	12/20E	12/21E	12/22E
Sales revenue	**3,789**	**4,629**	**5,959**	**7,571**
Cost of goods sold	2,850	3,467	4,347	5,417
EBITDA	**954**	**1,152**	**1,624**	**2,214**
EBIT	**182**	**347**	**571**	**843**
Net interest expense/(inc.)	291	301	603	786
Recurring PBT	**(176)**	**(127)**	**(143)**	**(54)**
Profit after tax	**(181)**	**(127)**	**(143)**	**(54)**
Reported net profit	**(182)**	**(127)**	**(143)**	**(54)**
Net profit (Credit Suisse)	**(182)**	**(127)**	**(143)**	**(54)**
Balance Sheet (Rmb mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Cash & cash equivalents	1,808	1,433	730	388
Current receivables	657	800	1,025	1,297
Inventories	0	0	0	0
Other current assets	2,763	3,188	3,862	4,679
Current assets	**5,228**	**5,422**	**5,618**	**6,364**
Property, plant & equip.	5,444	7,499	9,864	11,913
Investments	1,923	1,923	1,923	1,923
Intangibles	1,400	1,329	1,258	1,187
Other non-current assets	279	279	279	279
Total assets	**14,274**	**16,452**	**18,942**	**21,665**
Current liabilities	**4,469**	**7,135**	**9,053**	**11,113**
Total liabilities	**9,042**	**11,348**	**13,981**	**16,758**
Total debt	5,692	7,650	9,736	11,875
Shareholders' equity	**5,303**	**5,175**	**5,032**	**4,978**
Minority interests	279	279	279	279
Total liabilities & equity	**14,274**	**16,452**	**18,942**	**21,665**
Cash Flow (Rmb mn)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
EBIT	**182**	**347**	**571**	**843**
Net interest	(291)	(301)	(603)	(786)
Tax paid	(5)	0	0	0
Working capital	(631)	(136)	(77)	(122)
Other cash & non-cash items	772	805	1,054	1,371
Operating cash flow	**27**	**715**	**945**	**1,305**
Capex	(1,249)	(2,790)	(3,348)	(3,348)
Free cash flow to the firm	**(1,222)**	**(2,075)**	**(2,403)**	**(2,043)**
Investing cash flow	**(1,612)**	**(2,790)**	**(3,348)**	**(3,348)**
Equity raised	(3)	0	0	0
Dividends paid	0	0	0	0
Financing cash flow	**1,040**	**1,700**	**1,700**	**1,700**
Total cash flow	**(545)**	**(375)**	**(703)**	**(343)**
Adjustments	0	0	0	0
Net change in cash	**(545)**	**(375)**	**(703)**	**(343)**
Per share	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Shares (wtd avg.) (mn)	113	111	111	111
EPS (Credit Suisse) (Rmb)	**(1.62)**	**(1.14)**	**(1.28)**	**(0.48)**
DPS (Rmb)	0.00	0.00	0.00	0.00
Operating CFPS (Rmb)	0.24	6.41	8.47	11.71
Earnings	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Growth (%)				
Sales revenue	11.4	22.2	28.7	27.0
EBIT	(23.3)	90.2	64.7	47.7
EPS	10.0	29.4	(12.4)	62.4
Margins (%)				
EBITDA	25.2	24.9	27.3	29.2
EBIT	4.8	7.5	9.6	11.1
Valuation (x)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
P/E	(104.0)	(147.5)	(131.3)	(348.7)
P/B	3.54	3.63	3.73	3.77
Dividend yield (%)	0.0	0.0	0.0	0.0
EV/sales	6.0	5.5	4.7	4.0
EV/EBITDA	24.0	21.9	17.3	13.8
EV/EBIT	125.8	72.9	49.1	36.2
ROE analysis (%)	**12/19A**	**12/20E**	**12/21E**	**12/22E**
ROE	(3.4)	(2.4)	(2.8)	(1.1)
ROIC	2.4	3.4	4.5	5.6
Credit ratios	**12/19A**	**12/20E**	**12/21E**	**12/22E**
Net debt/equity (%)	74.2	121.8	181.5	234.1
Net debt/EBITDA (x)	4.07	5.40	5.54	5.19

Source: Company data, Refinitiv, Credit Suisse estimates

Company Background

21 Vianet provides data centre and cloud services in China

Blue/Grey Sky Scenario

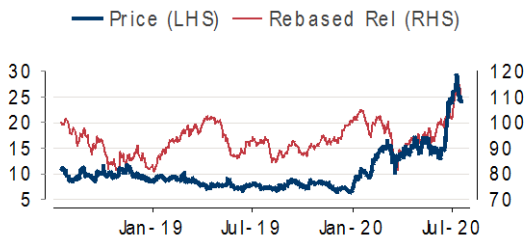
Our Blue Sky Scenario (US$) **28.50**

Under our 'blue-sky' scenario we assume more promising growth and lower risk than under our base case. This gives a 'blue-sky' valuation of US$28.5/ADS. At that value, the implied FY20 EV/EBITDA would be 18.3x

Our Grey Sky Scenario (US$) **15.30**

Under our 'grey-sky' scenario we assume lower growth and higher risk than under our base case. This gives a 'grey-sky' valuation of US$21.8/ADS. At that value, the implied FY20 EV/EBITDA would be 15.3x.

Share price performance



The price relative chart measures performance against the MSCI CHINA F IDX which closed at 9,617.98 on 17-Jul-2020

On 17-Jul-2020 the spot exchange rate was US$1/US$1

Companies Mentioned *(Price as of 19-Jul-2020)*

21Vianet Group (VNET.OQ, $24.11, OUTPERFORM[V], TP $25.0)
Accton (2345.TW, NT$236.5, NEUTRAL, TP NT$240.0)
Advanced Micro Devices, Inc. (AMD.OQ, $55.04, NEUTRAL[V], TP $33.0)
Alchip Tech (3661.TW, NT$480.0, OUTPERFORM[V], TP NT$630.0)
Aspeed (5274.TWO, NT$1255.0, OUTPERFORM[V], TP NT$1300.0)
Broadcom Ltd (AVGO.OQ, $312.71, OUTPERFORM, TP $400.0)
Dell Technologies (DELL.N, $60.37, NEUTRAL, TP $44.0)
Delta Electronics (2308.TW, NT$184.0, OUTPERFORM, TP NT$208.0)
Digital Realty Trust, Inc. (DLR.N, $143.75, OUTPERFORM, TP $164.0)
Equinix, Inc. (EQIX.OQ, $724.23, OUTPERFORM, TP $704.0)
Foxconn Industrial Internet (601138.SS, Rmb14.79, OUTPERFORM, TP Rmb17.0)
GDS Holdings Limited (GDS.OQ, $81.08, OUTPERFORM[V], TP $90.0)
GUC (3443.TW, NT$284.0, NEUTRAL[V], TP NT$250.0)
Hewlett Packard Enterprise (HPE.N, $9.67, UNDERPERFORM, TP $8.5)
Intel Corp. (INTC.OQ, $60.0, OUTPERFORM, TP $75.0)
International Business Machines (IBM.N, $125.11, OUTPERFORM, TP $150.0)
Inventec Co Ltd (2356.TW, NT$24.75, NEUTRAL, TP NT$24.0)
Keppel DC REIT (KEPE.SI, S$2.61, OUTPERFORM, TP S$2.91)
Lenovo Group Ltd (0992.HK, HK$4.55, NEUTRAL, TP HK$4.5)
MiTAC Holdings Corporation (3706.TW, NT$29.55, NEUTRAL, TP NT$32.2)
Micron Technology Inc. (MU.OQ, $49.47, OUTPERFORM[V], TP $90.0)
NVIDIA Corporation (NVDA.OQ, $408.06, OUTPERFORM[V], TP $425.0)
NetApp (NTAP.OQ, $44.81, OUTPERFORM[V], TP $53.0)
Parade Technologies (4966.TWO, NT$1075.0, NEUTRAL, TP NT$970.0)
Quanta Computer (2382.TW, NT$78.0, OUTPERFORM, TP NT$90.0)
SK Hynix Inc. (000660.KS, W82,900, OUTPERFORM, TP W118,000)
Samsung Electronics (005930.KS, W54,400, OUTPERFORM, TP W65,000)
Switch, Inc. (SWCH.N, $17.95, OUTPERFORM[V], TP $23.0)
Taiwan Semiconductor Manufacturing (2330.TW, NT$367.0, NEUTRAL, TP NT$365.0)
Wiwynn Corporation (6669.TW, NT$753.0, OUTPERFORM[V], TP NT$960.0)
Xilinx (XLNX.OQ, $100.49, OUTPERFORM, TP $100.0)

Disclosure Appendix

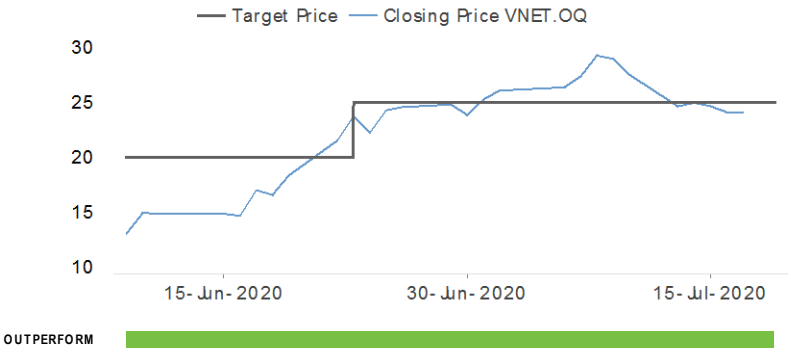
Analyst Certification

Randy Abrams, CFA, Jerry Su, Manish Nigam, John W. Pitzer, Pauline Chen, Harvie Chou, Keon Han, Sang Uk Kim, Kyna Wong, Chaolien Tseng, Hideyuki Maekawa, Akinori Kanemoto, Matthew Cabral, Sami Badri, Dalya Hahn, Haas Liu, Tina Long, Colin McCallum, CA, Nicholas Teh and Kenneth Fong each certify, with respect to the companies or securities that the individual analyzes, that (1) the views expressed in this report accurately reflect his or her personal views about all of the subject companies and securities and (2) no part of his or her compensation was, is or will be directly or indirectly related to the specific recommendations or views expressed in this report.

3-Year Price and Rating History for 21Vianet Group (VNET.OQ)

VNET.OQ	Closing Price	Target Price	
Date	(US$)	(US$)	Rating
09-Jun-20	13.05	20.00	O *
23-Jun-20	23.75	25.00	

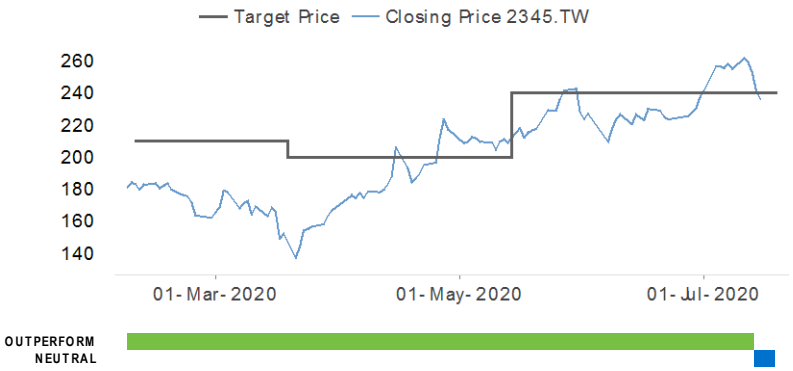
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for Accton (2345.TW)

2345.TW	Closing Price	Target Price	
Date	(NT$)	(NT$)	Rating
10-Feb-20	181.50	210.00	O *
19-Mar-20	149.00	200.00	
14-May-20	211.00	240.00	
15-Jul-20	252.50	240.00	N

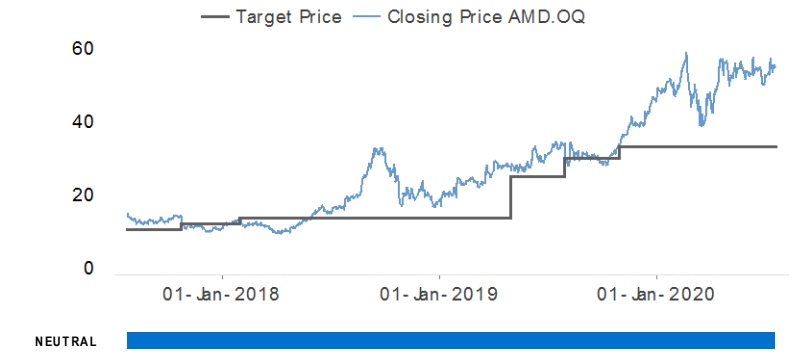
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for Advanced Micro Devices, Inc. (AMD.OQ)

AMD.OQ	Closing Price	Target Price	
Date	(US$)	(US$)	Rating
26-Jul-17	14.76	10.50	N
24-Oct-17	14.25	12.00	
31-Jan-18	13.74	13.50	
30-Apr-19	27.63	25.00	
30-Jul-19	33.87	30.00	
29-Oct-19	33.03	33.00	

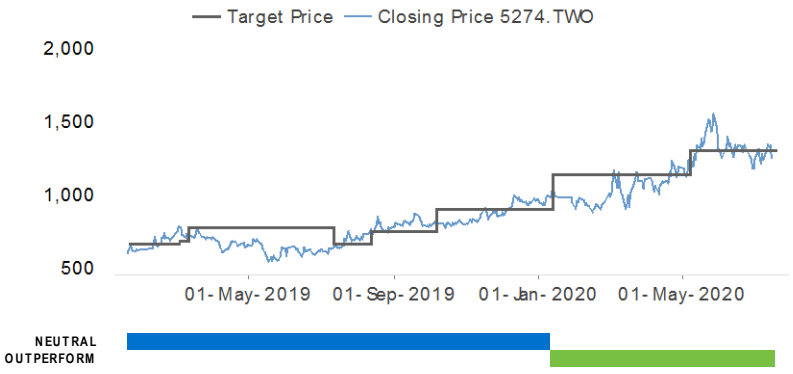
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for Aspeed (5274.TWO)

5274.TWO	Closing Price	Target Price	
Date	(NT$)	(NT$)	Rating
21-Jan-19	602.00	660.00	N *
04-Mar-19	749.00	681.00	
12-Mar-19	731.00	775.00	
12-Jul-19	631.00	660.00	
13-Aug-19	738.00	750.00	
07-Oct-19	814.00	900.00	
13-Jan-20	982.00	1140.00	O
08-May-20	1235.00	1300.00	

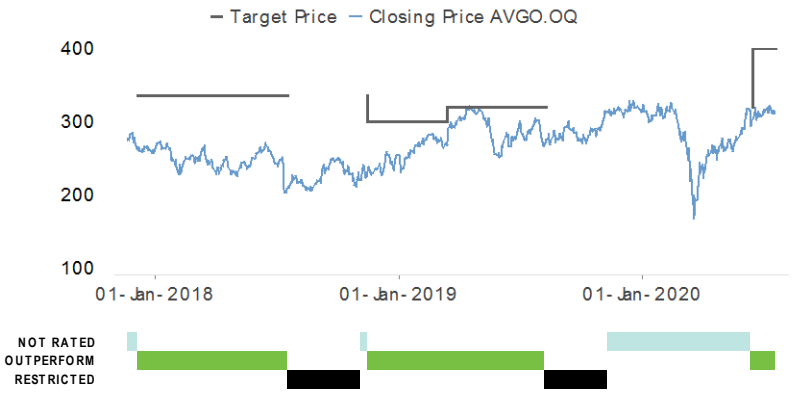
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for Broadcom Ltd (AVGO.OQ)

AVGO.OQ	Closing Price	Target Price	
Date	(US$)	(US$)	Rating
20-Nov-17	274.88		NR
05-Dec-17	261.65	335.00	O
19-Jul-18	210.37		R
06-Nov-18	228.25		NR
15-Nov-18	236.34	300.00	O
14-Mar-19	268.20	320.00	
09-Aug-19	275.73		R
11-Nov-19	312.75		NR
14-Jun-20	300.25	400.00	O

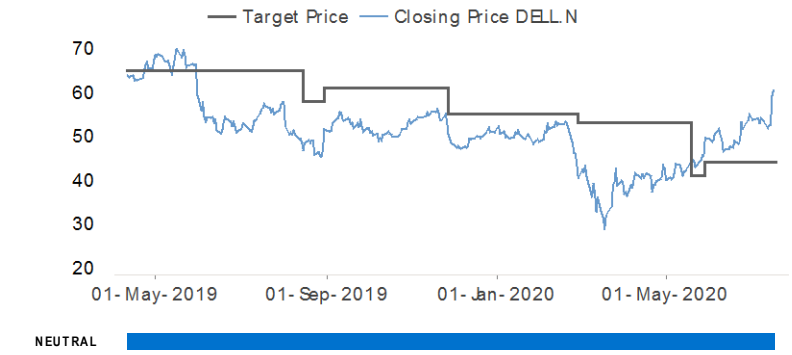
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for Dell Technologies (DELL.N)

DELL.N	Closing Price	Target Price	
Date	(US$)	(US$)	Rating
11-Apr-19	63.86	65.00	N *
15-Aug-19	46.90	58.00	
30-Aug-19	51.53	61.00	
27-Nov-19	50.32	55.00	
28-Feb-20	40.46	53.00	
19-May-20	44.04	41.00	
29-May-20	49.64	44.00	

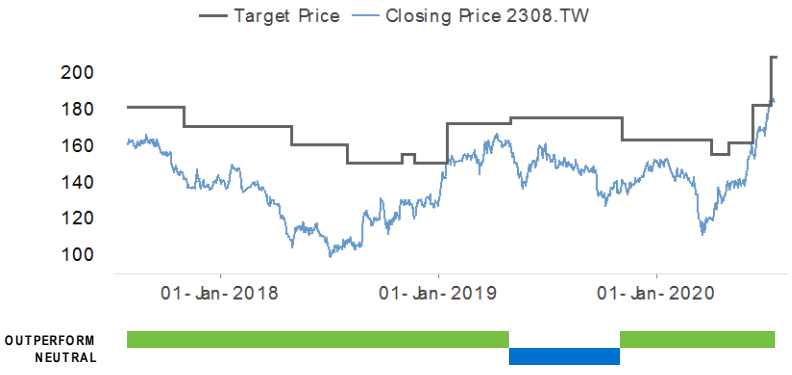
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for Delta Electronics (2308.TW)

2308.TW	Closing Price	Target Price	
Date	(NT$)	(NT$)	Rating
31-Jul-17	160.50	181.00	O
31-Oct-17	145.00	170.00	
30-Apr-18	108.00	160.00	
01-Aug-18	107.50	150.00	
31-Oct-18	130.00	155.00	
21-Nov-18	125.50	150.00	
16-Jan-19	149.50	172.00	
02-May-19	159.50	175.00	N
04-Nov-19	134.50	163.00	O
02-Apr-20	120.00	155.00	
30-Apr-20	140.00	161.00	
10-Jun-20	160.50	182.00	
10-Jul-20	183.50	208.00	

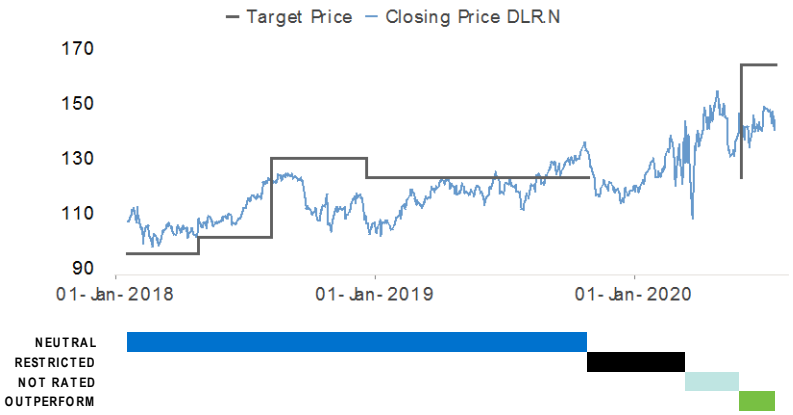
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for Digital Realty Trust, Inc. (DLR.N)

DLR.N	Closing Price	Target Price	
Date	(US$)	(US$)	Rating
17-Jan-18	107.01	95.00	N *
27-Apr-18	107.80	101.00	
08-Aug-18	121.54	130.00	
24-Sep-18	115.92		R
25-Sep-18	115.92	130.00	N
20-Dec-18	106.10	123.00	
29-Oct-19	130.59		R
16-Mar-20	128.31		NR
31-May-20	143.56	164.00	O

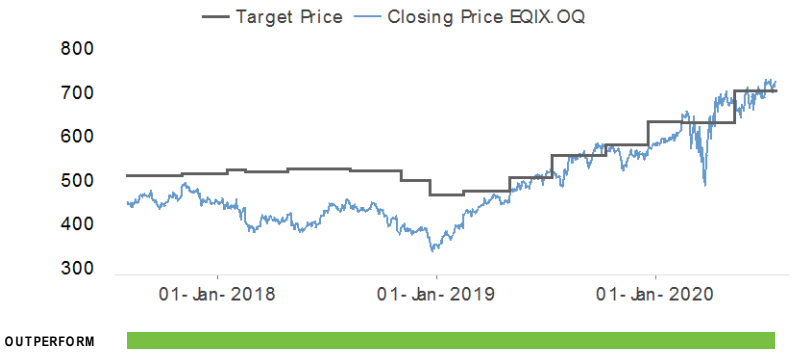
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for Equinix, Inc. (EQIX.OQ)

EQIX.OQ	Closing Price	Target Price	
Date	(US$)	(US$)	Rating
03-Aug-17	449.36	510.00	O
02-Nov-17	488.68	515.00	
17-Jan-18	441.90	524.00	
15-Feb-18	407.31	519.00	
27-Apr-18	421.15	525.00	
09-Aug-18	444.99	520.00	
02-Nov-18	392.43	500.00	
20-Dec-18	358.21	467.00	
14-Feb-19	420.59	474.00	
02-May-19	465.01	506.00	
11-Jul-19	523.88	556.00	
09-Oct-19	575.00	581.00	
19-Dec-19	575.92	634.00	
13-Feb-20	635.75	630.00	
11-May-20	678.00	704.00	

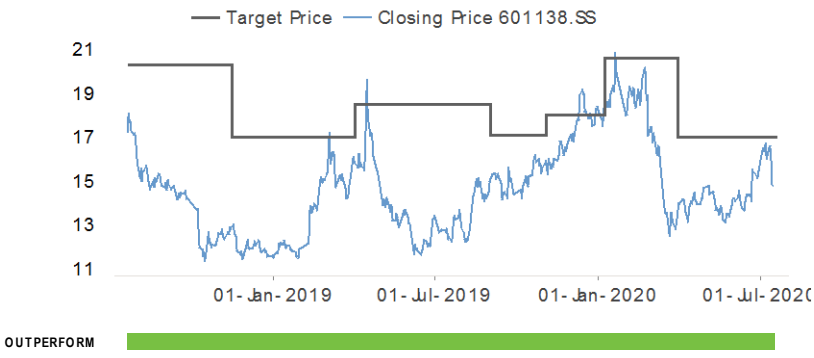
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for Foxconn Industrial Internet (601138.SS)

601138.SS	Closing Price	Target Price	
Date	(Rmb)	(Rmb)	Rating
23-Jul-18	17.25	20.30	O *
15-Nov-18	12.89	17.00	
03-Apr-19	16.08	18.50	
02-Sep-19	14.52	17.10	
04-Nov-19	15.78	18.00	
09-Jan-20	18.30	20.60	
31-Mar-20	13.21	17.00	

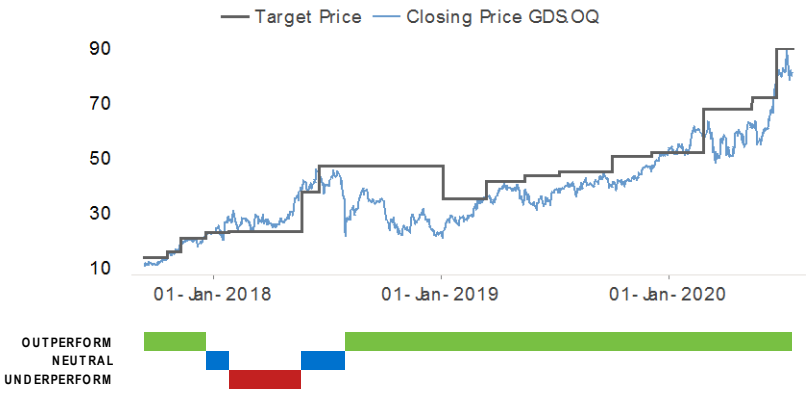
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for GDS Holdings Limited (GDS.OQ)

GDS.OQ	Closing Price	Target Price	
Date	(US$)	(US$)	Rating
12-Sep-17	10.90	13.80	O
19-Oct-17	14.72	15.80	
09-Nov-17	18.03	20.70	
20-Dec-17	22.58	23.00	N
26-Jan-18	27.46	23.10	U
23-May-18	39.26	37.50	N
20-Jun-18	43.43	47.00	
01-Aug-18	25.00	47.00	O
04-Jan-19	23.06	35.00	
14-Mar-19	35.58	41.50	
15-May-19	38.01	43.50	
10-Jul-19	37.98	45.00	
02-Oct-19	39.54	50.50	
05-Dec-19	47.15	52.00	
26-Feb-20	59.07	68.00	
14-May-20	60.88	72.00	
23-Jun-20	80.56	90.00	

** Asterisk signifies initiation or assumption of coverage.*

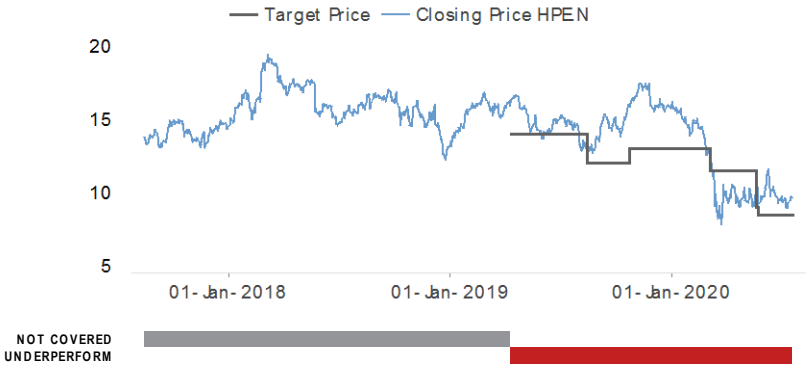


3-Year Price and Rating History for Hewlett Packard Enterprise (HPE.N)

HPE.N	Closing Price	Target Price	
Date	(US$)	(US$)	Rating
15-Aug-17	13.77		NC
11-Apr-19	16.27	14.00	U *
15-Aug-19	12.68	12.00	
24-Oct-19	15.89	13.00	
04-Mar-20	12.26	11.50	
19-May-20	10.04	9.00	
22-May-20	9.17	8.50	

** Asterisk signifies initiation or assumption of coverage.*

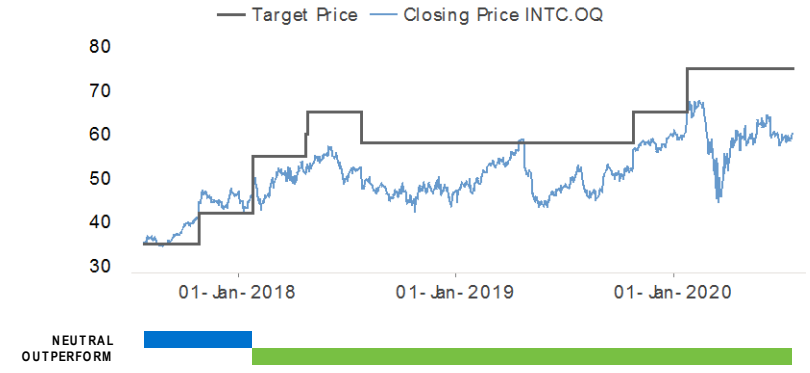
Effective July 3, 2016, NC denotes termination of coverage.



3-Year Price and Rating History for Intel Corp. (INTC.OQ)

INTC.OQ	Closing Price	Target Price	
Date	(US$)	(US$)	Rating
28-Jul-17	35.31	35.00	N
27-Oct-17	44.40	42.00	
26-Jan-18	50.08	55.00	O
24-Apr-18	51.45	60.00	
27-Apr-18	52.73	65.00	
27-Jul-18	47.68	58.00	
25-Oct-19	56.46	65.00	
24-Jan-20	68.47	75.00	

** Asterisk signifies initiation or assumption of coverage.*

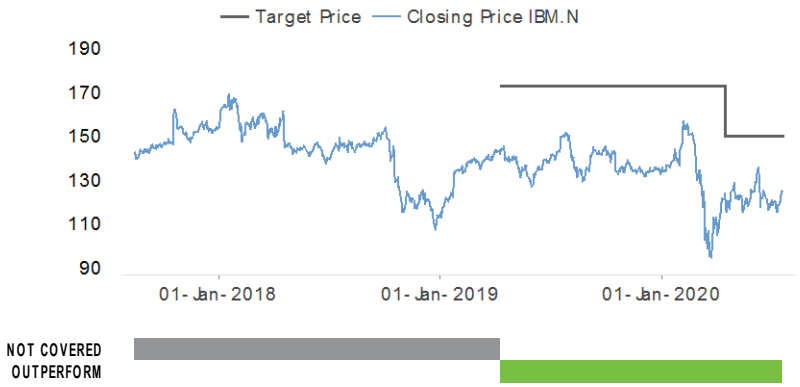


3-Year Price and Rating History for International Business Machines (IBM.N)

IBM.N	Closing Price	Target Price	
Date	(US$)	(US$)	Rating
19-Jul-17	147.53	110.00	U
15-Aug-17	142.07		NC
11-Apr-19	143.78	173.00	O *
15-Apr-20	118.69	150.00	

** Asterisk signifies initiation or assumption of coverage.*

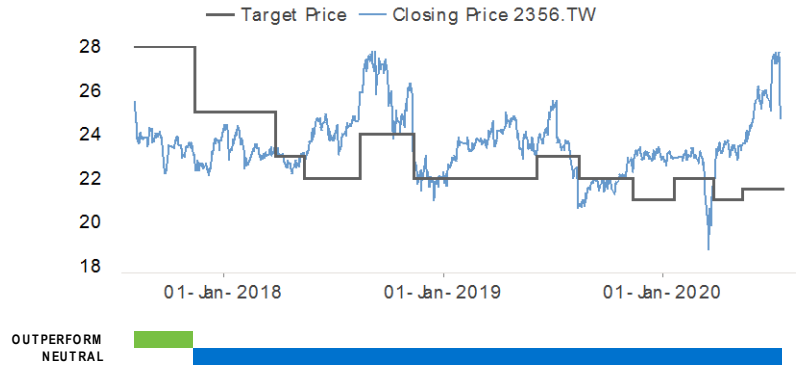
Effective July 3, 2016, NC denotes termination of coverage.



3-Year Price and Rating History for Inventec Co Ltd (2356.TW)

2356.TW	Closing Price	Target Price	
Date	(NT$)	(NT$)	Rating
07-Aug-17	25.45	28.00	O
13-Nov-17	23.05	25.00	N
27-Mar-18	23.35	23.00	
15-May-18	23.15	22.00	
15-Aug-18	25.00	24.00	
13-Nov-18	23.35	22.00	
30-May-19	23.85		*
06-Jun-19	22.95	23.00	N
14-Aug-19	21.70	22.00	
12-Nov-19	22.85	21.00	
20-Jan-20	22.90	22.00	
25-Mar-20	21.60	21.00	
13-May-20	23.50	21.50	

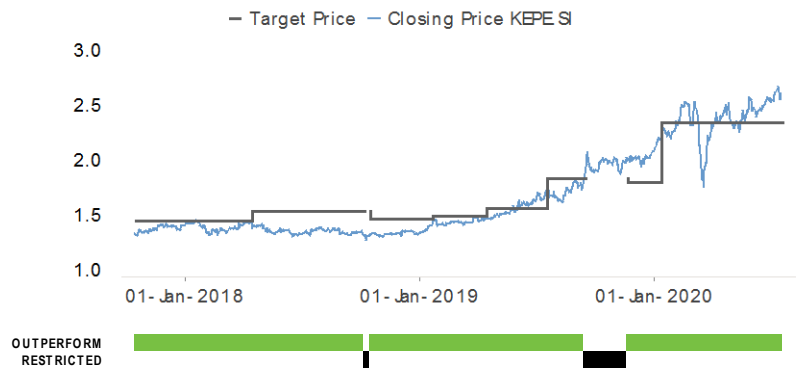
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for Keppel DC REIT (KEPE.SI)

KEPE.SI	Closing Price	Target Price	
Date	(S$)	(S$)	Rating
16-Oct-17	1.33	1.45	O
16-Apr-18	1.43	1.54	
18-Jul-18	1.36	1.53	
08-Oct-18	1.32		R
17-Oct-18	1.32	1.46	O
22-Jan-19	1.41	1.49	
16-Apr-19	1.46	1.56	
18-Jul-19	1.70	1.83	
16-Sep-19	1.77		R
21-Nov-19	2.00	1.80	O
13-Jan-20	2.20	2.34	

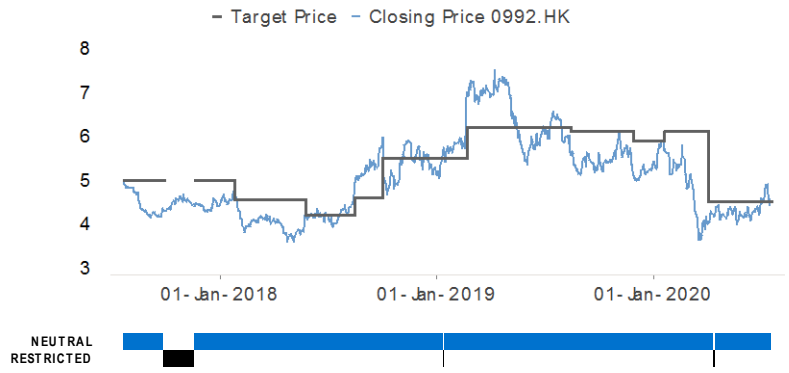
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for Lenovo Group Ltd (0992.HK)

0992.HK	Closing Price	Target Price	
Date	(HK$)	(HK$)	Rating
24-Jul-17	4.95	5.00	N
29-Sep-17	4.31		R
20-Nov-17	4.44	5.00	N
25-Jan-18	4.72	4.55	
25-May-18	4.18	4.20	
16-Aug-18	4.60	4.60	
02-Oct-18	5.76	5.50	
15-Jan-19	5.71		R
16-Jan-19	5.71	5.50	N
22-Feb-19	7.00	6.20	
30-May-19	5.62		*
06-Jun-19	5.63	6.20	N
15-Aug-19	5.64	6.10	
29-Nov-19	5.17	5.90	
20-Jan-20	5.86	6.10	
02-Apr-20	4.04	4.50	
14-Apr-20	4.17		R
17-Apr-20	4.38	4.50	N

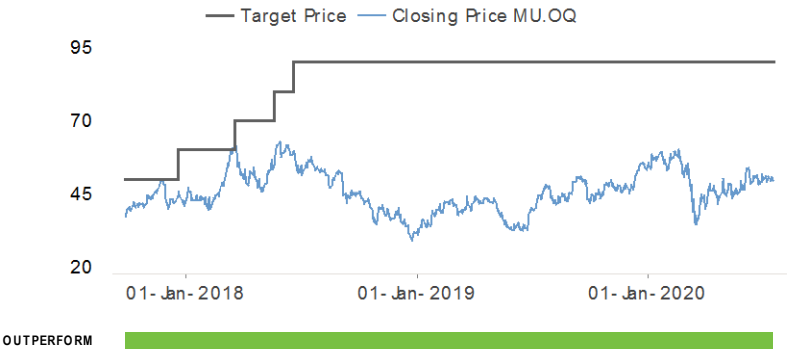
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for Micron Technology Inc. (MU.OQ)

MU.OQ	Closing Price	Target Price	
Date	(US$)	(US$)	Rating
27-Sep-17	37.09	50.00	O
19-Dec-17	43.98	60.00	
19-Mar-18	60.14	70.00	
21-May-18	55.48	80.00	
20-Jun-18	58.95	90.00	

** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for NVIDIA Corporation (NVDA.OQ)

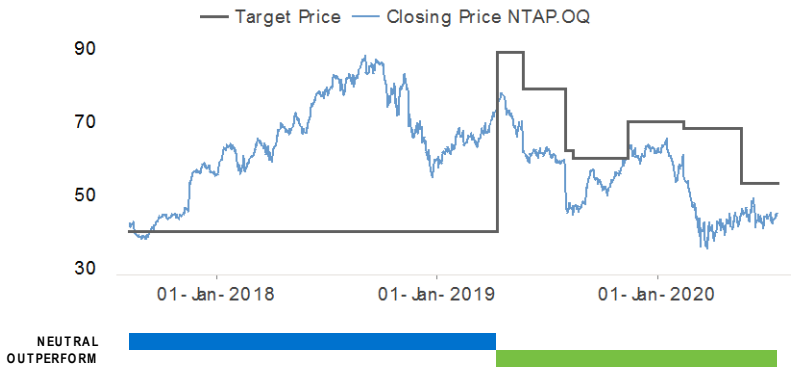
NVDA.OQ	Closing Price	Target Price	
Date	(US$)	(US$)	Rating
25-Nov-18	145.00	225.00	O *
11-Mar-19	161.14		R
01-May-20	282.78		NR
20-May-20	358.80	425.00	O

** Asterisk signifies initiation or assumption of coverage.*

3-Year Price and Rating History for NetApp (NTAP.OQ)

NTAP.OQ	Closing Price	Target Price	
Date	(US$)	(US$)	Rating
09-Aug-17	42.24	40.00	N
11-Apr-19	75.49	89.00	O *
23-May-19	61.66	79.00	
02-Aug-19	46.04	62.00	
15-Aug-19	46.47	60.00	
13-Nov-19	60.07	70.00	
13-Feb-20	55.18	68.00	
19-May-20	44.68	53.00	

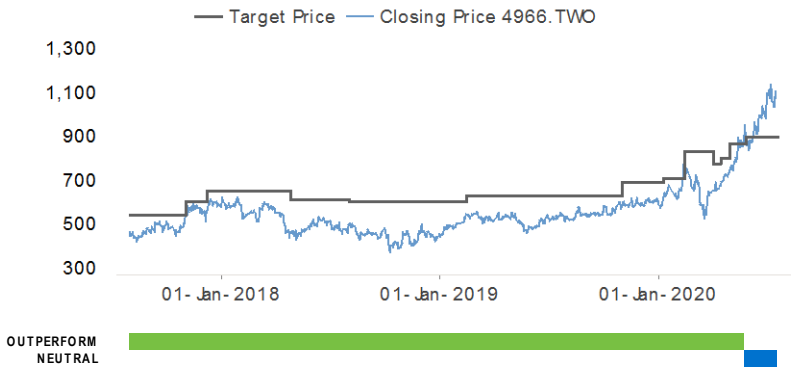
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for Parade Technologies (4966.TWO)

4966.TWO	Closing Price	Target Price	
Date	(NT$)	(NT$)	Rating
02-Aug-17	464.50	540.00	O
02-Nov-17	503.00	600.00	
07-Dec-17	512.00	650.00	
27-Apr-18	461.00	610.00	
02-Aug-18	459.00	600.00	
14-Feb-19	523.00	630.00	
01-Nov-19	570.00	690.00	
10-Jan-20	610.00	705.00	
13-Feb-20	710.00	830.00	
02-Apr-20	650.00	775.00	
14-Apr-20	669.00	800.00	
30-Apr-20	738.00	865.00	
27-May-20	916.00	895.00	N

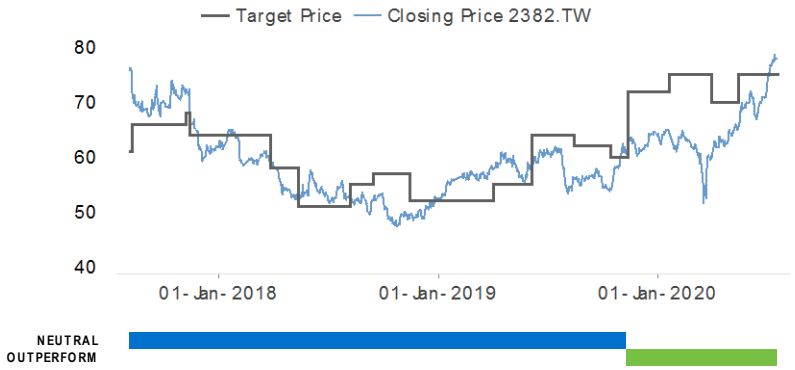
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for Quanta Computer (2382.TW)

2382.TW	Closing Price	Target Price	
Date	(NT$)	(NT$)	Rating
07-Aug-17	75.90	61.00	N
10-Aug-17	75.70	66.00	
07-Nov-17	72.00	68.00	
14-Nov-17	72.30	64.00	
28-Mar-18	59.20	58.00	
13-May-18	53.10	51.00	
08-Aug-18	53.10	55.00	
14-Sep-18	52.00	57.00	
14-Nov-18	49.50	52.00	
02-Apr-19	58.00	55.00	
30-May-19	56.70		*
06-Jun-19	58.20	64.00	N
14-Aug-19	56.30	62.00	
15-Oct-19	54.00	60.00	
13-Nov-19	60.90	72.00	O
20-Jan-20	65.00	75.00	
31-Mar-20	60.20	70.00	
14-May-20	65.00	75.00	

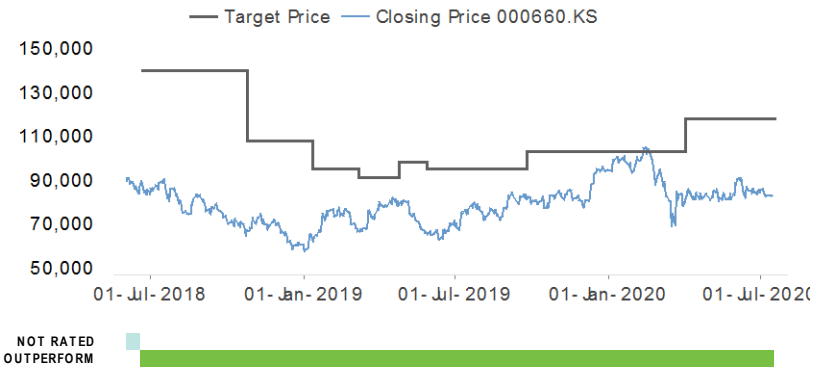
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for SK Hynix Inc. (000660.KS)

000660.KS	Closing Price	Target Price	
Date	(W)	(W)	Rating
04-Jun-18	89,800		NR
21-Jun-18	88,500	140,000	O
25-Oct-18	64,700	108,000	
11-Jan-19	65,100	95,000	
08-Mar-19	66,700	91,000	
25-Apr-19	80,200	98,000	
29-May-19	66,100	95,000	
25-Sep-19	81,900	103,000	
02-Apr-20	80,000	118,000	

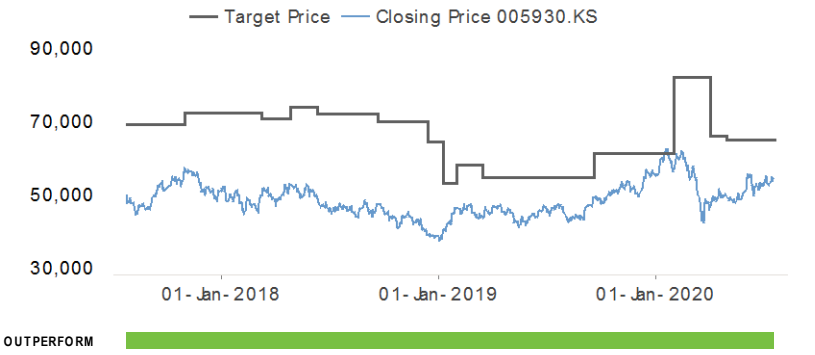
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for Samsung Electronics (005930.KS)

005930.KS	Closing Price	Target Price	
Date	(W)	(W)	Rating
27-Jul-17	49,800	69,200	O
31-Oct-17	55,080	72,400	
09-Mar-18	49,740	70,800	
27-Apr-18	53,000	74,000	
11-Jun-18	49,900	72,000	
21-Sep-18	47,400	70,000	
13-Dec-18	40,000	64,500	
08-Jan-19	38,100	53,000	
31-Jan-19	46,150	58,000	
15-Mar-19	44,200	54,800	
19-Sep-19	49,150	61,300	
31-Jan-20	56,400	82,000	
02-Apr-20	46,800	66,000	
29-Apr-20	50,000	65,000	

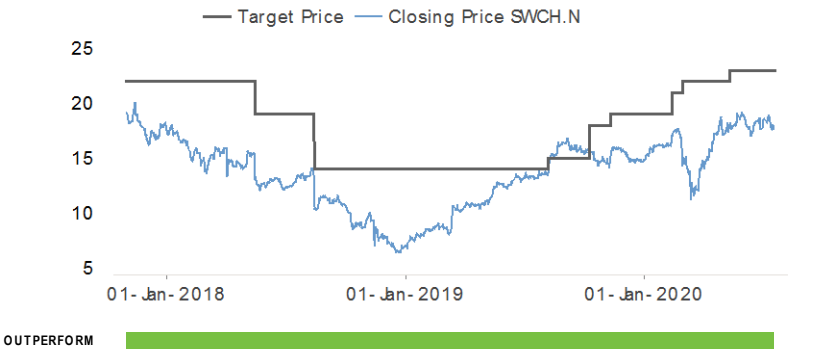
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for Switch, Inc. (SWCH.N)

SWCH.N	Closing Price	Target Price	
Date	(US$)	(US$)	Rating
31-Oct-17	19.13	22.00	O *
16-May-18	13.20	19.00	
14-Aug-18	10.85	14.00	
07-Aug-19	13.75	15.00	
09-Oct-19	15.51	18.00	
11-Nov-19	15.57	19.00	
12-Feb-20	17.05	21.00	
28-Feb-20	14.34	22.00	
11-May-20	18.17	23.00	

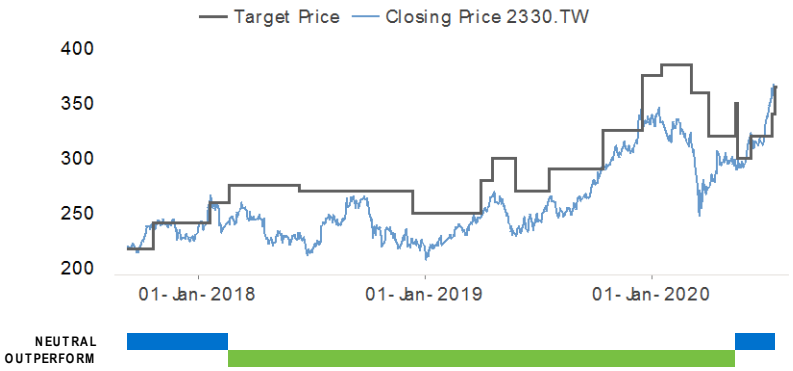
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for Taiwan Semiconductor Manufacturing (2330.TW)

2330.TW	Closing Price	Target Price	
Date	(NT$)	(NT$)	Rating
10-Sep-17	218.00	217.00	N
20-Oct-17	237.50	241.00	
19-Jan-18	255.50	259.00	
20-Feb-18	236.50	275.00	O
12-Jun-18	229.00	270.00	
12-Dec-18	226.50	250.00	
01-Apr-19	245.50	280.00	
19-Apr-19	264.50	300.00	
27-May-19	231.00	270.00	
19-Jul-19	259.00	290.00	
14-Oct-19	290.00	325.00	
16-Dec-19	336.00	375.00	
17-Jan-20	333.00	385.00	
04-Mar-20	320.50	360.00	
02-Apr-20	271.50	320.00	
15-May-20	298.00	350.00	
18-May-20	290.00	300.00	N
09-Jun-20	319.00	320.00	
13-Jul-20	354.50	340.00	
17-Jul-20	367.00	365.00	

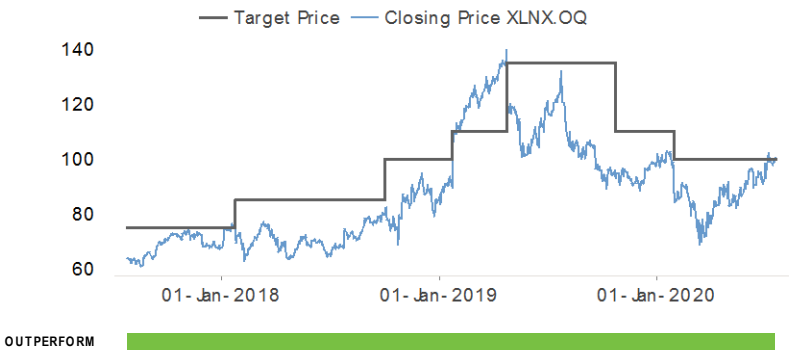
** Asterisk signifies initiation or assumption of coverage.*



3-Year Price and Rating History for Xilinx (XLNX.OQ)

XLNX.OQ	Closing Price	Target Price	
Date	(US$)	(US$)	Rating
27-Jul-17	63.84	75.00	O
24-Jan-18	73.48	85.00	
02-Oct-18	80.19	100.00	
23-Jan-19	89.55	110.00	
24-Apr-19	139.72	135.00	
24-Oct-19	93.12	110.00	
29-Jan-20	88.06	100.00	

** Asterisk signifies initiation or assumption of coverage.*



As of December 10, 2012 Analysts' stock rating are defined as follows:

Outperform (O) : The stock's total return is expected to outperform the relevant benchmark* over the next 12 months.

Neutral (N) : The stock's total return is expected to be in line with the relevant benchmark* over the next 12 months.

Underperform (U) : The stock's total return is expected to underperform the relevant benchmark* over the next 12 months.

**Relevant benchmark by region: As of 10th December 2012, Japanese ratings are based on a stock's total return relative to the analyst's coverage universe which consists of all companies covered by the analyst within the relevant sector, with Outperforms representing the most attractive, Neutrals the less attractive, and Underperforms the least attractive investment opportunities. As of 2nd October 2012, U.S. and Canadian as well as European (excluding Turkey) ratings are based on a stock's total return relative to the analyst's coverage universe which consists of all companies covered by the analyst within the relevant sector, with Outperforms representing the most attractive, Neutrals the less attractive, and Underperforms the least attractive investment opportunities. For Latin America, Turkey and Asia (excluding Japan and Australia), stock ratings are based on a stock's total return relative to the average total return of the relevant country or regional benchmark (India - S&P BSE Sensex Index); prior to 2nd October 2012 U.S. and Canadian ratings were based on (1) a stock's absolute total return potential to its current share price and (2) the relative attractiveness of a stock's total return potential within an analyst's coverage universe. For Australian and New Zealand stocks, the expected total return (ETR) calculation includes 12-month rolling dividend yield. An Outperform rating is assigned where an ETR is greater than or equal to 7.5%; Underperform where an ETR less than or equal to 5%. A Neutral may be assigned where the ETR is between -5% and 15%. The overlapping rating range allows analysts to assign a rating that puts ETR in the context of associated risks. Prior to 18 May 2015, ETR ranges for Outperform and Underperform ratings did not overlap with Neutral thresholds between 15% and 7.5%, which was in operation from 7 July 2011.*

Restricted (R) : In certain circumstances, Credit Suisse policy and/or applicable law and regulations preclude certain types of communications, including an investment recommendation, during the course of Credit Suisse's engagement in an investment banking transaction and in certain other circumstances.

Not Rated (NR) : Credit Suisse Equity Research does not have an investment rating or view on the stock or any other securities related to the company at this time.
Not Covered (NC) : Credit Suisse Equity Research does not provide ongoing coverage of the company or offer an investment rating or investment view on the equity security of the company or related products.

Volatility Indicator [V] : A stock is defined as volatile if the stock price has moved up or down by 20% or more in a month in at least 8 of the past 24 months or the analyst expects significant volatility going forward.

Analysts' sector weightings are distinct from analysts' stock ratings and are based on the analyst's expectations for the fundamentals and/or valuation of the sector* relative to the group's historic fundamentals and/or valuation:
Overweight : The analyst's expectation for the sector's fundamentals and/or valuation is favorable over the next 12 months.
Market Weight : The analyst's expectation for the sector's fundamentals and/or valuation is neutral over the next 12 months.
Underweight : The analyst's expectation for the sector's fundamentals and/or valuation is cautious over the next 12 months.
**An analyst's coverage sector consists of all companies covered by the analyst within the relevant sector. An analyst may cover multiple sectors.*

Credit Suisse's distribution of stock ratings (and banking clients) is:

Global Ratings Distribution

Rating	Versus universe (%)	Of which banking clients (%)
Outperform/Buy*	49%	(32% banking clients)
Neutral/Hold*	37%	(27% banking clients)
Underperform/Sell*	12%	(21% banking clients)
Restricted	1%	

**For purposes of the NYSE and FINRA ratings distribution disclosure requirements, our stock ratings of Outperform, Neutral, and Underperform most closely correspond to Buy, Hold, and Sell, respectively; however, the meanings are not the same, as our stock ratings are determined on a relative basis. (Please refer to definitions above.) An investor's decision to buy or sell a security should be based on investment objectives, current holdings, and other individual factors.*

Important Global Disclosures

Credit Suisse's research reports are made available to clients through our proprietary research portal on CS PLUS. Credit Suisse research products may also be made available through third-party vendors or alternate electronic means as a convenience. Certain research products are only made available through CS PLUS. The services provided by Credit Suisse's analysts to clients may depend on a specific client's preferences regarding the frequency and manner of receiving communications, the client's risk profile and investment, the size and scope of the overall client relationship with the Firm, as well as legal and regulatory constraints. To access all of Credit Suisse's research that you are entitled to receive in the most timely manner, please contact your sales representative or go to https://plus.credit-suisse.com .
Credit Suisse's policy is to update research reports as it deems appropriate, based on developments with the subject company, the sector or the market that may have a material impact on the research views or opinions stated herein.
Credit Suisse's policy is only to publish investment research that is impartial, independent, clear, fair and not misleading. For more detail please refer to Credit Suisse's Policies for Managing Conflicts of Interest in connection with Investment Research: https://www.credit-suisse.com/sites/disclaimers-ib/en/managing-conflicts.html .
Any information relating to the tax status of financial instruments discussed herein is not intended to provide tax advice or to be used by anyone to provide tax advice. Investors are urged to seek tax advice based on their particular circumstances from an independent tax professional.
Credit Suisse has decided not to enter into business relationships with companies that Credit Suisse has determined to be involved in the development, manufacture, or acquisition of anti-personnel mines and cluster munitions. For Credit Suisse's position on the issue, please see https://www.credit-suisse.com/media/assets/corporate/docs/about-us/responsibility/banking/policy-summaries-en.pdf .
The analyst(s) responsible for preparing this research report received compensation that is based upon various factors including Credit Suisse's total revenues, a portion of which are generated by Credit Suisse's investment banking activities

Target Price and Rating
Valuation Methodology and Risks: (12 months) for 21Vianet Group (VNET.OQ)

Method: Our target price of US$25.0 for 21 Vianet Group Inc is based on a discounted cash flow (DCF) built out to 2028, using a WACC (weighted average cost of capital) of 9.4% and a terminal growth rate of 3.8%. We rate VNET OUTPERFORM based on rising data use and cloud computing in China, together with valuation.

Risk: Risks that could impede achievement of our target price of US$25.0 for 21 Vianet Group Inc and OUTPERFORM rating include: higher- or lower-than-expected growth of IDC revenue in the Chinese market, being squeezed by its most important supplier and competitor, Unicom and Telecom, and a lack of barrier to new entrants. An additional risk is the company's variable interest entity (VIE) structure.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Accton (2345.TW)

Method: We have a NEUTRAL rating and a 12M TP of NT$240 for Accton, based on 20x 2021E P/E (price-to-earnings), 1 standard deviation above past three years' average, as we believe Accton is the key beneficiary in the ODM Direct trend take-off in switch with widening competitive advantages vs peers, migration to faster speed for switch, and new demand from 5G proliferation and new customers.

However, shares have appreciated nearly 90% since the trough in mid-March, as we see limited upsides especially on weaker enterprise demand and slower growth on new customer and 400G push-out amid COVID-19.

Risk: Key risks to our NEUTRAL rating and NT$240 target price for Accton include: (1) stronger-/weaker-than-expected demand for data-centre; (2) faster/slower ramp of 400G data-centre switch; (3) market share gain/loss for enterprise and ODM business; (4) faster/slower revenue growth for 5G and telco; and (5) stronger/weaker gross margin.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Advanced Micro Devices, Inc. (AMD.OQ)

Method: Our $33 target price is based on 33x CY20 EPS. We rate AMD Neutral reflecting our expectation for competitive responses from peers to mitigate the translation of unit share in to Rev share along with our expectation for higher opex to mitigate OpM leverage.

Risk: Risks to our $33 target price and Neutral rating are (1) Technology Risk: as with all technology companies, AMD is at the risk of a step function technology introduction into the marketplace, which could render many or all of AMD's technologies obsolete and (2) Competitive Risk: AMD's primary competitor INTC has over 85% of the MPU market, a strong balance sheet and brand equity. Competitive activities by INTC (including pricing) could severely impact the AMD business.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Alchip Tech (3661.TW)

Method: Our OUTPERFORM rating and target price of NT$630 for Alchip Tech is based on 30x P/E (price-to-earnings), factoring in our expectation for 30% sales CAGR from 2019-22, implying 20% upside from the current price of NT$522. We believe the upper half of the long-term valuation should be supported by the company's earnings upside from stronger-than-expected China PC CPU replacement demand and faster-than-expected Phytium's server CPU penetration into the China government and SOE projects.

Risk: Risk to our OUTPERFORM rating and target price of NT$630 for Alchip Tech include: (1) Macro uncertainty leads to slower semiconductor investment, (2) Timing uncertainty in AI chipset development, (3) Customers shift to foundry direct business model, (4) Slower local CPU penetration in China, (5) U.S. further expands its ban on China companies' access to IP/EDA tools.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Aspeed (5274.TWO)

Method: We have an OUTPERFORM rating on Aspeed as we believe the current share price has not yet reflected the company's high share in data centre and improving market outlook this year while its other growth options will also ramp. Our target price of NT$1,300 is based on 35x 2021E earnings, from the upper half of its historical range, due to potential for the sector valuation to rebound in 2020 following the cyclical semiconductor slowdown and closer to resumption of hyperscale build-outs also as 5G's higher volume commercialisation approaches in 2020 and new products push for customer adoption.

Risk: Risks to our target price of NT$1,300 and OUTPERFORM rating for Aspeed: (1) data-centre growth hits a prolonged slowdown, (2) share gains in BMC do not materialise in servers or networking, (3) competition emerges on new product generations or customers insource, new products fail to gain market acceptance and the valuations for semiconductor growth companies derate.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Broadcom Ltd (AVGO.OQ)

Method: Our Outperform rating and $400 target price for AVGO are based on 18.6x times CY21 EV/FCF, modestly below peers despite superior returns and profitability. We rate AVGO Outperform as we expect it to appreciate more than its peers.

Risk: Risks to our $400 target price and Outperform rating for AVGO are (1) competitive pressures in the Wireless business, (2) high customer concentration, (3) failure to execute on cost synergies, and (4) the highly cyclical nature of the semiconductor industry.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Dell Technologies (DELL.N)

Method: We rate Dell Neutral with a $44 target price. Our $44 12-month target price is based on a 50/50 split between P/E (8x CY21 EPS of $6.17) and EV/EBITDA (8x CY21 EBITDA of $10.7bn). Our Neutral rating contrasts Dell's "family" approach that positions the company well for the coming shift to hybrid cloud with high leverage that leaves little room for error vs. a decelerating IT spending environment ahead.

Risk: Risks to our $44 target price and Neutral rating include elevated leverage, interest rate policy, storage integration, decelerating IT spending, increased competition, FX, global economic growth, COVID, and trade tensions.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Delta Electronics (2308.TW)

Method: Our target price of NT$208 for Delta is based on 21x 2021E EPS, using +1 STD P/E. We rate Delta at OUTPERFORM, as we remain positive on Delta's 5G and EV story, and near-term catalysts include strong 2Q result and resilient margin guidance.

Risk: Risks that could impede achievement of our NT$208 target price for Delta could include: (1) end-market demand, especially on industrial automation, (2) opex controls, as the company is migrating from a component supplier to a solution provider, and (3) execution capability to improve Eltek's OPM, through cross-selling opportunities. Risks to our OUTPERFORM rating for Delta could include (1) slower-than-expected OPM expansion, due to weak end-demand or mis-execution in M&A; and (2) unexpected changes in Delta's business strategy due to a new management team.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Digital Realty Trust, Inc. (DLR.N)

Method: Our $164 target price and Outperform rating for Digital Realty is computed from a 25.5x P/ AFFO multiple applied on our 2021 AFFO per share estimate of $6.42.

Risk: Risks to our $164 target price and Outperform rating for Digital Realty are 1) changes in I.T. architecture displacing Digital's technology and real estate, 2) speculative data center developments that may compress market pricing and impact Digital's margins and profits, 3) economic risk associated with a slowdown in overall I.T. spending, 4) regulatory risks associated with changes in data sovereignty laws, requiring companies to own and manage their own data centers rather than leasing from multi-tenant data centers, and 5) REIT qualification risk where the company must abide by numerous complex rules to qualify for its tax free status.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Equinix, Inc. (EQIX.OQ)

Method: Our Outperform rating and target price of $704 are based on 25x our FY21E AFFOS of $25.74 per share and a DCF valuation assuming a terminal growth of 2.25% and WACC of 5.3%.

Risk: Risks to our $704 target price and Outperform rating for Equinix are 1) changes in I.T. architecture displacing Equinix's technology and real estate, 2) speculative data center developments that may compress market pricing and impact Equinix's margins and profits, 3) economic risk associated with a slowdown in overall I.T. spending, 4) regulatory risks associated with changes in data sovereignty laws, requiring companies to own and manage their own data centers rather than leasing from multi-tenant data centers, and 5) REIT qualification risk where the company must abide by numerous complex rules to qualify for its tax free status.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Foxconn Industrial Internet (601138.SS)

Method: We have an OUTPERFORM rating on FII, as we believe FII will stay as the core profit generator of Hon Hai, driven by 5G build out and strong momentum in cloud business with further upside from share gains. Our TP of Rmb17.0 is based on 18x NTM P/E, at +1 STD P/E, to reflect solid cloud growth and gradual 5G roll-out in China, despite rising demand uncertainties on smartphones.

Risk: Risks to our OUTPERFORM rating and TP of Rmb17.0 for FII include: (1) Apple product demand, given FII's 20-30% revenue exposure to that customer; (2) RMB/USD trend, as most of its revenue is dominated by RMB and USD; (3) slower-than-expected progress in installing BEACON in Hon Hai's factories; (4) faster-than-expected market share loss or weaker-than-expected demand in server, networking and telecom business; and (5) Shanghai stock market multiple fluctuations, which may pose a risk to our TP multiple.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for GDS Holdings Limited (GDS.OQ)

Method: Using a WACC of 8.8% (risk free rate 3.0%, ERP 5.5%, Beta 1.4, target gearing 33%) and terminal growth of 4.3%, we derive a DCF-based target price of US$90.0/ADS for GDS Holdings Limited. Given we believe GDS's execution, as a non-State Owned Enterprise (SOE) in a very high growth segment of China's telecom services space, has been very good, we maintain our OUTPERFORM rating.

Risk: The risks to our target price of US$90.00 and OUTPERFORM rating for GDS Holdings Limited include: (1) lower-than-expected utilization and (2) higher-than-expected capex incurred for IDC construction.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for GUC (3443.TW)

Method: Our NEUTRAL rating and target price of NT$250 for GUC is based on 28x P/E (price-to-earnings). We believe the company's share is fairly valued at the upper half of its historical range, factoring in its opportunity in 5G and AI, though the timing of the project ramp for meaningful revenue contribution and profitability remain uncertainty.

Risk: Risk to our NEUTRAL rating and target price of NT$250 for GUC include: (1) Macro uncertainty leads to slower semiconductor investment, (2) Timing uncertainty in AI chipset development, (3) Customers shift to foundry direct business model.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Hewlett Packard Enterprise (HPE.N)

Method: Our $8.5 target price and Underperform rating for HPE are based on 6.5x our CY2021 EPS estimate of $1.33. Our multiple is below the company's 11.0x average since it spun off its software business in 2017, reflecting the downward pressure we expect on HPE's Operational Services business, caused by a declining hardware installed base. We rate HPE Underperform because we expect (1) declining Server revenue; (2) pressure on high-margin Services; and (3) FCF structurally below non-GAAP net income.

Risk: Risks to our $8.5 target price and Underperform rating for HPE are resilience of server revenue, stronger services sales, more rapid reduction in restructuring costs, currency (67% of revenues are earned overseas), supply chain disruptions, a slowdown in enterprise IT spending, international trade talks.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Intel Corp. (INTC.OQ)

Method: Our $75 target price and Outperform rating for Intel are based on 15x 2020E P/E. Our Outperform rating is based upon the following: INTC remains well levered to Data Growth not only in DCG but also in its IoT and NSG businesses. We believe the company's business model/IP has significant barriers to entry (evidenced by one of the highest "R&D + Cap to Revenue" ratio), and we continue to argue that Moore's Law has been the cornerstone of Tech economics for 40 years and that INTC will be the Last-man-standing on Moore's Law, leading to market share gains in Compute (including Mobile), as well as Foundry.

Risk: Risks to our $75 target price and Outperform rating for Intel are aggressive pricing, higher manufacturing spending, loss of market share in key enterprise markets, reversal of recent strength in servers where Intel has renewed momentum, ability to maintain share in desktop and mobile, with the new Core i3/i5/i7 offering, lower gross margin due to higher manufacturing costs, and seeing slower-than-expected unit growth of PC units.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for International Business Machines (IBM.N)

Method: We rate IBM Outperform with a $150 target price. Red Hat is a strategic win in a hybrid-first world: We firmly believe hybrid is the steady-state equilibrium for enterprise IT. IBM and Red Hat together form a powerful competitor to guide customers through this shift. Our target price is based on a 12x multiple, applied to our CY21E Non-GAAP EPS forecast of $12.33.

Risk: Risks to our Outperform rating on IBM and $150 target price include Red Hat deal integration, slowing IT spending, rising interest rates, and FX rates.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Inventec Co Ltd (2356.TW)

Method: We rate Inventec NEUTRAL with a 12-month target price of NT$24.0 based on 13x 2021E P/E (price-to-earnings), 2 standard deviation above its historical average. We like Inventec as we believe it will be the key beneficiary on improving hyperscalers' capex spending from 2020; however, we see risk of continued share loss in IAC capping the upside for its earnings growth.

Risk: The risks to our NEUTRAL rating and NT$24.0 target price for Inventec include: (1) PC share gain/loss and overall market momentum; (2) better/weaker than expected IAC momentum; (3) currency impact on the data-centre business; and (4) higher/lower than expected production cost.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Keppel DC REIT (KEPE.SI)

Method: Our target price of S$2.91 for Keppel DC REIT is based on our dividend discount valuation model for existing assets, assuming a 2% risk-free rate, an average cost of equity of 6.3% and a 2% terminal growth rate. We have also factored in S$1.8 bn worth of acquisitions over the next three years. The stock offers a long WALE of nine years, high barriers to entry, and has the strongest organic and inorganic growth potential amongst the REITs, hence our OUTPERFORM rating.

Risk: Key investment risks to our target price of S$2.91 and OUTPERFORM rating for Keppel DC REIT include risks related to land tenure, industry-related risks, refinancing risks, acquisition risks and other macroeconomic concerns.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Lenovo Group Ltd (0992.HK)

Method: We rate Lenovo NEUTRAL with a HK$4.50 12-month target price based on 10x 12M GAAP EPS (earnings per share). We expect cost pressures to hit the Data Centre business pushing out the turnaround time frame. We believe data centre can be a profitable business in the long term. The share trades at a three-year range of 9-16x. Near-term, we remain cautious on Lenovo largely due to risks of overall soft consumer products demand and commentary suggesting slowing data-centre capex.

Risk: Risks to our NEUTRAL rating and HK$4.50 12-month price target for Lenovo include: (1) faster- or slower-than-expected cost savings in both the Mobile and Data Centre businesses; (2) faster- or slower-than-expected growth in Data Centre; (3) Lenovo MBG growth or slowdown; and (4) MBG market share gain or loss.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for MiTAC Holdings Corporation (3706.TW)

Method: We have a NEUTRAL rating and NT$32.2 target price based on 10x 2021E P/E, its past three-year trading average, as we remain cautious on weaker enterprise demand due to weaker macro economy amid COVID-19, despite the increasing workload shift to the cloud which should benefit MiTAC as a result of its exposure to key hyperscalers in the US. In addition, we remain cautious on the auto demand outlook on weaker consumer spending from COVID-19.

Risk: Key risks to our NEUTRAL rating and NT$32.2 target price include: (1) better or weaker cloud momentum amid COVID-19; (2) improving or weakening auto demand; and (3) higher or lower contribution from its key non-operational equity investment entities.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Micron Technology Inc. (MU.OQ)

Method: Our target price of $90 represents 12x F4Q21 annualized EPS as MU cyclically recovers. We rate MU OUTPERFORM as we believe that MU is near trough levels and see fundamentals improving mid-2019 (1) we expect pricing to start stabilising, (2) structurally, Memory is a different industry now—higher concentration than ever, more diversified demand, and slowing supply—and we argue margins are more resilient now than in the past, and (3) we continue to argue that its strategic value continues to be under-appreciated, particularly given memory's importance to the new data economy.

Risk: Risks to MU's $90 target price and our OUTPERFORM rating are: (1) pricing pressure in the DRAM and NAND markets; (2) execution issues in NAND; and (3) execution issues in converting to 1z DRAM. Major risks for our OUTPERFORM rating are (1) DRAM market could continue to weaken, (2) the company could continue to have execution issues in DRAM, and (3) new entrants from China could enter the market.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for NVIDIA Corporation (NVDA.OQ)

Method: Our $425 target price and Outperforming rating for NVDA are based on 40x FY23 EV/FCF We rate NVDA the stock Outperform as we expect it to appreciate more than its peers.

Risk: Risks to our $425 target price and Outperform rating are (1) a shift in consumer preferences in the gaming industry; (2) volatile demand in NVDA's key growth segments; and (3) competition in the Gaming, AV, and AI markets.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for NetApp (NTAP.OQ)

Method: Our $53 target price and Outperform rating for NetApp are based on 13x our CY2021E non-GAAP EPS forecast of $4.11. Our multiple is in line with the company's five-year average, given our view that the business is on more solid footing now vs. several years ago given their position in all-flash. We rate NetApp Outperform as we expect it to appreciate more than its peers.

Risk: Risks to our $53 target price and Outperform rating for NetApp are slowing all-flash growth, customer concentration (two represent 10% of revenues), a lack of margin expansion, decelerating IT spending, increased competition, FX, and macro factors.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Parade Technologies (4966.TWO)

Method: Our target price of NT$970 for Parade Technologies is based on 21x 2021 P/E (price-to-earnings) or 17x cash adjusted P/E, vs historical 11-22x P/E range, given its strengthened industry position on eDP and SIPI IC business, as well as it has developed new products for data centre applications. We rate Parade NEUTRAL as it is well positioned to benefit from the display resolution migration and opportunities in the high-speed transmission interfaces, but believe the upside has already been priced in.

Risk: Risks that could impede the achievement of our NT$970 target price and NEUTRAL rating for Parade Technologies include: (1) faster- or slower-than-expected migration to eDP T-Con v1.3 among Apple products leading to lower revenue growth; (2) higher- or lower-than-expected penetration of the eDP T-Con among non-Apple NB models; and (3) success or failure to diversify into non-eDP products, including SIPI source IC, high-speed interface, TDDI, etc.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Quanta Computer (2382.TW)

Method: We have an OUTPERFORM rating for Quanta because we see its cloud data centre sales accelerating along with 5G take-off, leveraging its long experience and design know-how. Its diversified customer base also provides more stable profitability growth. Our target price of NT$90.0 is based on 16.5x 2021E forward P/E, 2SD above the one-year average.

Risk: Downside risks to our OUTPERFORM rating and NT$90.0 target price for Quanta include the following: (1) worse-than-expected notebook/Apple Macbook and Watch/server and data centre demand and share gains; and (2) currency and macro impact on non-operating income.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for SK Hynix Inc. (000660.KS)

Method: Our target price of W118,000 for SK Hynix is based on P/B of 1.4x to 2021E BVPS, which is mid-cycle average. We assign an OUTPERFORM rating on the back of better-than-feared DRAM margin in FY19E. Key drivers are (1) better-than-earlier-expected DRAM supply-demand dynamics in FY19E mainly due to lesser bit supply growth on technology difficulties; (2) new DRAM bit demand generation from servers; and (3) better shareholder returns with rising free cash flow generation.

Risk: Risks that could impede achievement of our target price of W118,000 and OUTPERFORM rating for SK Hynix include: (1) slower-than-expected DRAM demand growth; (2) faster-than-expected DRAM ASP decrease; and (3) higher-than-expected DRAM supply growth amid DRAM gross wafers adds.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Samsung Electronics (005930.KS)

Method: Our 12-month target price of W65,000 for Samsung Electronics is based on 1.5x FY21E mid-cycle P/B. The dividend yield should rise for the next few years, driving P/E multiple expansion as Samsung Electronics' yield approaches the global tech average of about 2.5%. We assign an OUTPERFORM rating to the stock given our confidence on higher earnings and dividends led by, resilient DRAM profitability, OLED or 3D NAND top-line growth, smartphone recovery with new product-cycle, and a more proactive shareholder return policy.

Risk: Risks that may impede the achievement of our 12-month target price of W65,000 and our OUTPERFORM rating for Samsung Electronics include: (1) smartphone margin sustainability given intensifying competition, (2) an earlier China entrance into 3D NAND, and (3) worse-than-expected memory pricing.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Switch, Inc. (SWCH.N)

Method: Our $23 target price and Outperform rating based on our discounted cash flow model with a WACC of 6.4% and a terminal growth rate of 2.0%.

Risk: Risks to our Outperform rating and $23 target price for Switch are: 1) changes in I.T. architecture displacing Switch technology, 2) speculative data center developments that may compress market pricing and impact profits, 3) revenue concentration, 4) management and board structure, and 5) share ownership control.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Taiwan Semiconductor Manufacturing (2330.TW)

Method: Our NT$365 target price for TSMC is based on 18.5x 2021E EPS (earnings per share), implying 3.2x P/B (price-to-book), near the midpoint of its average 11-15x and 2.5-3.5x range. We see its business outlook improving, and technology leadership should keep its market share and profitability intact; dividends will likely rise again as capex moderates. We therefore have an NEUTRAL rating on the stock.

Risk: Risks that could impede achievement of our NT$365 target price and NEUTRAL rating for TSMC would include: fierce competition, demand failing to pick up, or Apple orders not being as strong as expected.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Wiwynn Corporation (6669.TW)

Method: We have an OUTPERFORM rating and NT$960 target price based on 15x 2021E P/E, 0.5 standard deviations above its average since the Mainboard listing, as we believe Wiwynn to be a key beneficiary from the increasing workload shift to the cloud given its leading shares with the key US hyperscalers especially from new mega data centre ramp by a major US social media company with expected completion by end-2020. In addition, we expect Wiwynn will see further sales uplift from new hyperscale client ramp from 2H20 as impacts from COVID-19 gradually subside. From 2021, we believe edge compute and carrier-premise equipment to also take off along with the proliferation of 5G.

Risk: Key risks to our OUTPERFORM rating and NT$960 target price include: (1) weaker capex outlook by two key customers due to softer macro from amid COVD-19; (2) higher key components pricing could lead to lower profits margin; and (3) continued push-out of new hyperscaler clients ramp.

Target Price and Rating
Valuation Methodology and Risks: (12 months) for Xilinx (XLNX.OQ)

Method: Our Outperform rating and TP to $100 for Xilinx represents 32.3x CY21 EPS -- while not outright cheap, we see significant Rev growth optionality from a 5G Comms TAM orders of magnitude the 4G TAM and DataCenter Rev that is expected to grow to $1bn by FY23 from $200m in FY19 - both of which underpin our OP rating.

Risk: Risks to our Outperform rating and our target price of $100 for Xilinx include 1) end-market and customer concentration as well as stronger competition in the PLD market, 2) operating expenses remaining at elevated levels, and 3) emerging markets weaker than expected.

Please refer to the firm's disclosure website at https://rave.credit-suisse.com/disclosures/view/selectArchive for the definitions of abbreviations typically used in the target price method and risk sections.

See the Companies Mentioned section for full company names
Credit Suisse currently has, or had within the past 12 months, the following as investment banking client(s): HPE.N, INTC.OQ, DLR.N, MU.OQ, NTAP.OQ, AVGO.OQ, IBM.N, DELL.N, SWCH.N, 0992.HK, NVDA.OQ, KEPE.SI, VNET.OQ, GDS.OQ, 000660.KS, AMD.OQ
Credit Suisse provided investment banking services to the subject company (HPE.N, INTC.OQ, DLR.N, MU.OQ, NTAP.OQ, AVGO.OQ, IBM.N, DELL.N, SWCH.N, 0992.HK, NVDA.OQ, KEPE.SI, VNET.OQ, GDS.OQ, 000660.KS, AMD.OQ) within the past 12 months.
Within the last 12 months, Credit Suisse has received compensation for non-investment banking services or products from the following issuer(s): HPE.N, INTC.OQ, DLR.N, AVGO.OQ, 005930.KS, IBM.N, DELL.N, KEPE.SI, 000660.KS, AMD.OQ
Credit Suisse has managed or co-managed a public offering of securities for the subject company (HPE.N, DLR.N, MU.OQ, AVGO.OQ, IBM.N, DELL.N, 0992.HK, KEPE.SI, 000660.KS) within the past 12 months.
Within the past 12 months, Credit Suisse has received compensation for investment banking services from the following issuer(s): HPE.N, INTC.OQ, DLR.N, MU.OQ, AVGO.OQ, IBM.N, DELL.N, 0992.HK, NVDA.OQ, KEPE.SI, VNET.OQ, GDS.OQ, 000660.KS, AMD.OQ
Credit Suisse expects to receive or intends to seek investment banking related compensation from the subject company (HPE.N, INTC.OQ, DLR.N, MU.OQ, NTAP.OQ, 601138.SS, AVGO.OQ, 005930.KS, IBM.N, DELL.N, XLNX.OQ, SWCH.N, 0992.HK, NVDA.OQ, 000660.KS, AMD.OQ) within the next 3 months.
Credit Suisse currently has, or had within the past 12 months, the following issuer(s) as client(s), and the services provided were non-investment-banking, securities-related: HPE.N, INTC.OQ, AVGO.OQ, 005930.KS, IBM.N, DELL.N, KEPE.SI
Credit Suisse currently has, or had within the past 12 months, the following issuer(s) as client(s), and the services provided were non-investment-banking, non securities-related: HPE.N, INTC.OQ, DLR.N, AVGO.OQ, 005930.KS, IBM.N, 000660.KS, AMD.OQ
Credit Suisse acts as a market maker in the shares, depositary receipts, interests or units issued by, and/or any warrants or options on these shares, depositary receipts, interests or units of the following subject issuer(s): 0992.HK.
Credit Suisse or a member of the Credit Suisse Group is a market maker or liquidity provider in the securities of the following subject issuer(s): VNET.OQ, 2345.TW, AMD.OQ, 3661.TW, 5274.TWO, AVGO.OQ, DELL.N, 2308.TW, DLR.N, EQIX.OQ, 601138.SS, GDS.OQ, 3443.TW, HPE.N, INTC.OQ, IBM.N, 2356.TW, KEPE.SI, 0992.HK, 3706.TW, MU.OQ, NVDA.OQ, NTAP.OQ, 4966.TWO, 2382.TW, 000660.KS, 005930.KS, SWCH.N, 2330.TW, 6669.TW, XLNX.OQ
A member of the Credit Suisse Group is party to an agreement with, or may have provided services set out in sections A and B of Annex I of Directive 2014/65/EU of the European Parliament and Council ("MiFID Services") to, the subject issuer (HPE.N, INTC.OQ, DLR.N, MU.OQ, NTAP.OQ, AVGO.OQ, IBM.N, DELL.N, SWCH.N, 0992.HK, NVDA.OQ, KEPE.SI, VNET.OQ, GDS.OQ, 000660.KS, AMD.OQ) within the past 12 months.
As of the date of this report, Credit Suisse beneficially own 1% or more of a class of common equity securities of (3661.TW, 2345.TW, 5274.TWO, 3443.TW, 3706.TW, 4966.TWO).

For date and time of production, dissemination and history of recommendation for the subject company(ies) featured in this report, disseminated within the past 12 months, please refer to the link: https://rave.credit-suisse.com/disclosures/view/report?i=534443&v=6wcou9ppevbc09dy0mnjy077r .

Important Regional Disclosures
Singapore recipients should contact Credit Suisse AG, Singapore Branch for any matters arising from this research report.
The analyst(s) involved in the preparation of this report may participate in events hosted by the subject company, including site visits. Credit Suisse does not accept or permit analysts to accept payment or reimbursement for travel expenses associated with these events.
For Credit Suisse Securities (Canada), Inc.'s policies and procedures regarding the dissemination of equity research, please visit https://www.credit-suisse.com/sites/disclaimers-ib/en/canada-research-policy.html.
Investors should note that income from such securities and other financial instruments, if any, may fluctuate and that price or value of such securities and instruments may rise or fall and, in some cases, investors may lose their entire principal investment.
Taiwanese Disclosures: This research report is for reference only. Investors should carefully consider their own investment risk and note they may be subject to the applicable rules and regulations in Taiwan. Investment results are the responsibility of the investor. Reports written by Taiwan based analysts on non-Taiwan listed companies are not considered as recommendations to

buy or sell securities. Reports may not be reproduced without the permission of Credit Suisse. Pursuant to the 'Taiwan Stock Exchange Regulations Governing Securities Firms Recommending Trades in Securities to Customers' and the 'Taipei Exchange Rules Governing Securities Firms Recommending Trades in Securities to Customers', in order for a non-client of Credit Suisse AG, Taipei Securities Branch to receive this research report, no provision by such non-client of the content of the report to a third party, nor any conflict of interest, is permitted. By receiving this research report, any such non-client is deemed to acknowledge and accept our terms and disclaimers included herein.

As at the date of this report, Credit Suisse has financial interests that aggregate to an amount equal to or more than 1% of the market capitalization of (0992.HK).

This research report is authored by:

Credit Suisse (Hong Kong) Limited Manish Nigam ; Kyna Wong ; Chaolien Tseng ; Tina Long ; Colin McCallum, CA ; Kenneth Fong
Credit Suisse AG, Singapore Branch.....Nicholas Teh
Credit Suisse Securities (Japan) Limited..... Hideyuki Maekawa ; Akinori Kanemoto
Credit Suisse Securities (Europe) Limited, Seoul Branch.....Keon Han ; Sang Uk Kim
Credit Suisse AG, Taipei Securities Branch..... Randy Abrams, CFA ; Jerry Su ; Pauline Chen ; Harvie Chou ; Haas Liu
Credit Suisse Securities (USA) LLC..... John W. Pitzer ; Matthew Cabral ; Sami Badri ; Dalya Hahn

To the extent this is a report authored in whole or in part by a non-U.S. analyst and is made available in the U.S., the following are important disclosures regarding any non-U.S. analyst contributors: The non-U.S. research analysts listed below (if any) are not registered/qualified as research analysts with FINRA. The non-U.S. research analysts listed below may not be associated persons of CSSU and therefore may not be subject to the FINRA 2241 and NYSE Rule 472 restrictions on communications with a subject company, public appearances and trading securities held by a research analyst account.

Credit Suisse (Hong Kong) Limited Manish Nigam ; Kyna Wong ; Chaolien Tseng ; Tina Long ; Colin McCallum, CA ; Kenneth Fong
Credit Suisse AG, Singapore Branch.....Nicholas Teh
Credit Suisse Securities (Japan) Limited..... Hideyuki Maekawa ; Akinori Kanemoto
Credit Suisse Securities (Europe) Limited, Seoul Branch.....Keon Han ; Sang Uk Kim
Credit Suisse AG, Taipei Securities Branch..... Randy Abrams, CFA ; Jerry Su ; Pauline Chen ; Harvie Chou ; Haas Liu

Important disclosures regarding companies that are the subject of this report are available by calling +1 (877) 291-2683. The same important disclosures, with the exception of valuation methodology and risk discussions, are also available on Credit Suisse's disclosure website at https://rave.credit-suisse.com/disclosures . For valuation methodology and risks associated with any recommendation, price target, or rating referenced in this report, please refer to the disclosures section of the most recent report regarding the subject company.

考研资料：数学、英语、政治、管综、西综、法硕等（整合各大机构）
英语类：四六级万词班专四专八雅思等
财经类：初级会计、中级会计、注册会计、高级会计、税务师、会计实操、证券从业、基金从业、资产评估、初级审
公务员：国考、省考、事业单位、军队文职、三支一扶微信 2270291360
银行：银行招聘、笔试、面试
教师资格：小学、中学、教师招聘面试
建筑：一建、二建、消防、造价
法考：主观题、客观题
多平台网课：涵盖职场、办公技能、编程、文案写作、情感心理、穿搭技巧、理财投资健身减肥摄影技术等优质内容
精选资料：Excel 教程、PPT 模板、简历模板、PS 教程、PPT 教程、素描、烹饪、小语种、CAD 教程、PR 教程、UI 课程、自媒体、写作、计算机二级、钢琴、Python、书法、吉他、kindle 电子书、演讲.....持续更新中...
押题：提供考前冲刺押题（初级会计、中级会计、注册会计、一建、二建、教资、四六级、证券、基金、期货等等），麻麻再也不用担心我考不过了。
资料领取微信：1131084518
行业报告：20000 份+持续更新

英语四六级备考资料	计算机二级备考资料	150 所高校考研专业课资料
两小时搞定毛概马原思修近代史纲	高数(微积分)+线性代数+概率论	素描 0 基础入门教程
教师资格证全套备考资料	普通话考试资料礼包	书法教程微信 2270291360
大学生英语竞赛备考资料	大学生数学竞赛备考资料	1000 份各行业营销策划方案合集
挑战杯/创青春/互联网+竞赛资料	电子设计竞赛必备资料	街舞 0 基础入门教程
托福雅思备考资料	大学物理学科攻略合集	动漫自学教程
SCI 最全写作攻略	TEM4/TEM8 专四专八备考资料	教师资格证面试试讲万能模板
360 份精美简历模板	数学建模 0 基础从入门到精通	100 套快闪 PPT 模板
Vlog 制作最全攻略	超强 PR 模板	42 套卡通风 PPT 模板
PS 零基础教程微信 1131084518	PS 高级技能教程	63 套酷炫科技 PPT 模板
好用到极致的 PPT 素材	128 套中国风 PPT 模板	32 套 MBE 风格 PPT 模板
327 套水彩风 PPT 模板	295 套手绘风 PPT 模板	54 套毕业答辩专属 PPT
196 套日系和风 PPT 模板	82 套文艺清新 PPT 模板	57 套思维导图 PPT 模板
163 套学术答辩 PPT 模板	53 套北欧风 PPT 模板	34 套温暖治愈系 PPT 模板
118 套国潮风 PPT 模板	30 套仙系古风 PPT	126 套黑板风 PPT 模板
114 套星空风格 PPT 模板	192 套欧美商务风 PPT 模板	42 套绚丽暈染风 PPT
50 套精美 INS 风 PPT 模板	56 套水墨风 PPT 模板	137 套清爽夏日风 PPT 模板
98 套森系 PPT 模板	25 套简约通用 PPT 模板	记忆力训练教程
300 套教学说课 PPT 模板	123 套医学护理 PPT 模板	AE 动态模板微信 2270291360
毕业论文资料礼包	教师资格证重点笔记+易错题集	表情包制作教程
吉他自学教程（送 6000 谱）	钢琴自学教程（送 1000 谱）	区块链从入门到精通资料
2000 部 TED 演讲视频合集	Excel 从入门到精通自学教程	单片机教程
230 套可视化 Excel 模板	1000 款 PR 预设+音效	1000 份实习报告模板
手绘自学教程微信 1131084518	单反从入门到精通教程	人力资源管理师备考资料
英语口语自学攻略	粤语 0 基础从入门到精通教程	证券从业资格证备考资料
日语自学教程	韩语自学教程	PHP 从入门到精通教程
法语学习资料	西班牙语学习资料	炒股+投资理财从入门到精通教程
全国翻译专业资格考试备考资料	BEC 初级+中级+高级全套备考资料	大数据学习资料
SPSS 自学必备教程	Origin 自学必备教程	会计实操资料
LaTeX 全套教程+模板	EndNote 教程+模板	小提琴 0 基础入门自学教程
GRE 超全备考资料	200 份医学习题合集	司考备考资料

思维导图教程＋素材	20000 份行业研究报告	一级造价工程师备考资料

上万 GB 教学资料（均全套,非杂乱）免费领取微信 1131084518

《闪电式百万富翁》实战版+升级版

易经+道德经+易学名师全集+风水学+算命学+起名+++等等（全套 1000 多 GB）

心理学+NLP 教练技术+精神分析+亲子家庭教育+催眠+++等等（更新超 2000GB）

大学-已更新至 9333 个课程+高中+初中+小学-全套资料（超过 2 万 GB）

陈安之	曾仕强	马云	杜云生	翟鸿燊	刘一秒	俞凌雄
王健林	余世维	雷军	周文强	安东尼罗宾	董明珠	李嘉诚
徐鹤宁	冯晓强	李践	刘克亚	罗伯特清崎	戴志强	李伟贤
苏引华	史玉柱	李强	俞敏洪	杰亚伯拉罕	周鸿祎	唐骏
梁凯恩	陈永亮	傅佩荣	贾长松	易发久	李彦宏	湖畔大学
李开复	聂枭	悟空道场	魏星	姬剑晶	其他名师全集	其他资料下载
王兴	王智华	智多星	陈文强	周导		微信 2270291360
泡妞	撩汉	泡仔	房中术	性福课	驻容术	泡妞撩汉性福合集

注：太多了，无法全部一一列出。。。

全套专题系列【微信 1131084518】

记忆力训练	形象礼仪	健康养生	企业管理	沟通技巧
演讲与口才	经理修炼	MBA 讲座	时间管理	战略经营
企业文化	销售心理	管理素质	国学讲座	执行力
团队管理	领导艺术	员工激励	潜能激发	谈判技巧
绩效管理	薪酬管理	43 份直销制度	电话销售	人力管理
客户服务	创业指南	市场营销	餐饮管理	保险讲座
品牌营销	酒店管理	汽车 4S 店	众筹资料	销售技巧

兴趣爱好：	钓鱼教程	魔术教学	炒股教学	美术教学	书法教学
音乐乐器：	萨克斯教学	电子琴教学	小提琴	古筝教学	钢琴教学
	吉他教学				
体育运动：	篮球教学	足球教学	羽毛球教学	兵乓球教学	太极拳教学
	围棋教学	高尔夫球			
生活实用：	插花教学	茶艺-茶道	唱歌教学	单反相机摄影	毛线编织
	小吃+美食				
语言学习：	英语				
电脑 IT：	办公 office	PS 美工教学			

暗号：666

免费领取资料微信

1131084518

微信1131084518

撩汉liaohan.net

最好资源zuihaoziyuan.com

This report is produced by subsidiaries and affiliates of Credit Suisse operating under its Global Markets Division. For more information on our structure, please use the following link: https://www.credit-suisse.com/who-we-are This report may contain material that is not directed to, or intended for distribution to or use by, any person or entity who is a citizen or resident of or located in any locality, state, country or other jurisdiction where such distribution, publication, availability or use would be contrary to law or regulation or which would subject Credit Suisse or its affiliates ("CS") to any registration or licensing requirement within such jurisdiction. All material presented in this report, unless specifically indicated otherwise, is under copyright to CS. None of the material, nor its content, nor any copy of it, may be altered in any way, transmitted to, copied or distributed to any other party, without the prior express written permission of CS. All trademarks, service marks and logos used in this report are trademarks or service marks or registered trademarks or service marks of CS or its affiliates.The information, tools and material presented in this report are provided to you for information purposes only and are not to be used or considered as an offer or the solicitation of an offer to sell or to buy or subscribe for securities or other financial instruments. CS may not have taken any steps to ensure that the securities referred to in this report are suitable for any particular investor. CS will not treat recipients of this report as its customers by virtue of their receiving this report. The investments and services contained or referred to in this report may not be suitable for you and it is recommended that you consult an independent investment advisor if you are in doubt about such investments or investment services. Nothing in this report constitutes investment, legal, accounting or tax advice, or a representation that any investment or strategy is suitable or appropriate to your individual circumstances, or otherwise constitutes a personal recommendation to you. Please note in particular that the bases and levels of taxation may change. Information and opinions presented in this report have been obtained or derived from sources believed by CS to be reliable, but CS makes no representation as to their accuracy or completeness. CS accepts no liability for loss arising from the use of the material presented in this report, except that this exclusion of liability does not apply to the extent that such liability arises under specific statutes or regulations applicable to CS. This report is not to be relied upon in substitution for the exercise of independent judgment. CS may have issued, and may in the future issue, other communications that are inconsistent with, and reach different conclusions from, the information presented in this report. Those communications reflect the different assumptions, views and analytical methods of the analysts who prepared them and CS is under no obligation to ensure that such other communications are brought to the attention of any recipient of this report. Some investments referred to in this report will be offered solely by a single entity and in the case of some investments solely by CS, or an associate of CS or CS may be the only market maker in such investments. Past performance should not be taken as an indication or guarantee of future performance, and no representation or warranty, express or implied, is made regarding future performance. Information, opinions and estimates contained in this report reflect a judgment at its original date of publication by CS and are subject to change without notice. The price, value of and income from any of the securities or financial instruments mentioned in this report can fall as well as rise. The value of securities and financial instruments is subject to exchange rate fluctuation that may have a positive or adverse effect on the price or income of such securities or financial instruments. Investors in securities such as ADR's, the values of which are influenced by currency volatility, effectively assume this risk. Structured securities are complex instruments, typically involve a high degree of risk and are intended for sale only to sophisticated investors who are capable of understanding and assuming the risks involved. The market value of any structured security may be affected by changes in economic, financial and political factors (including, but not limited to, spot and forward interest and exchange rates), time to maturity, market conditions and volatility, and the credit quality of any issuer or reference issuer. Any investor interested in purchasing a structured product should conduct their own investigation and analysis of the product and consult with their own professional advisers as to the risks involved in making such a purchase. Some investments discussed in this report may have a high level of volatility. High volatility investments may experience sudden and large falls in their value causing losses when that investment is realised. Those losses may equal your original investment. Indeed, in the case of some investments the potential losses may exceed the amount of initial investment and, in such circumstances, you may be required to pay more money to support those losses. Income yields from investments may fluctuate and, in consequence, initial capital paid to make the investment may be used as part of that income yield. Some investments may not be readily realisable and it may be difficult to sell or realise those investments, similarly it may prove difficult for you to obtain reliable information about the value, or risks, to which such an investment is exposed. This report may provide the addresses of, or contain hyperlinks to, websites. Except to the extent to which the report refers to website material of CS, CS has not reviewed any such site and takes no responsibility for the content contained therein. Such address or hyperlink (including addresses or hyperlinks to CS's own website material) is provided solely for your convenience and information and the content of any such website does not in any way form part of this document. Accessing such website or following such link through this report or CS's website shall be at your own risk.

This report is issued and distributed in **European Union (except Germany and Spain):** by Credit Suisse Securities (Europe) Limited, One Cabot Square, London E14 4QJ, England, which is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority; **Spain:** Credit Suisse Securities, Sociedad de Valores, S.A. ("CSSSV") regulated by the Comision Nacional del Mercado de Valores; **Germany:** Credit Suisse (Deutschland) Aktiengesellschaft regulated by the Bundesanstalt fuer Finanzdienstleistungsaufsicht ("BaFin"). **United States:** Credit Suisse Securities (USA) LLC; **Canada:** Credit Suisse Securities (Canada), Inc.; **Switzerland:** Credit Suisse AG; **Brazil:** Banco de Investimentos Credit Suisse (Brasil) S.A or its affiliates; **Mexico:** Banco Credit Suisse (México), S.A., Institución de Banca Múltiple, Grupo Financiero Credit Suisse (México) and Casa de Bolsa Credit Suisse (México), S.A. de C.V., Grupo Financiero Credit Suisse (México) ("Credit Suisse Mexico"). This document has been prepared for information purposes only and is exclusively distributed in Mexico to Institutional Investors. Credit Suisse Mexico is not responsible for any onward distribution of this report to non-institutional investors by any third party. The authors of this report have not received payment or compensation from any entity or company other than from the relevant Credit Suisse Group company employing them; **Japan:** by Credit Suisse Securities (Japan) Limited, Financial Instruments Firm, Director-General of Kanto Local Finance Bureau (*Kinsho*) No. 66, a member of Japan Securities Dealers Association, The Financial Futures Association of Japan, Japan Investment Advisers Association, Type II Financial Instruments Firms Association; **Hong Kong:** Credit Suisse (Hong Kong) Limited; **Australia:** Credit Suisse Equities (Australia) Limited; **Thailand:** Credit Suisse Securities (Thailand) Limited, regulated by the Office of the Securities and Exchange Commission, Thailand, having registered address at 990 Abdulrahim Place, 27th Floor, Unit 2701, Rama IV Road, Silom, Bangrak, Bangkok10500, Thailand, Tel. +66 2614 6000; **Malaysia:** Credit Suisse Securities (Malaysia) Sdn Bhd; **Singapore:** Credit Suisse AG, Singapore Branch; **India:** Credit Suisse Securities (India) Private Limited (CIN no.U67120MH1996PTC104392) regulated by the Securities and Exchange Board of India as Research Analyst (registration no. INH 000001030) and as Stock Broker (registration no. INZ000248233), having registered address at 9th Floor, Ceejay House, Dr.A.B. Road, Worli, Mumbai - 18, India, T- +91-22 6777 3777; **South Korea:** Credit Suisse Securities (Europe) Limited, Seoul Branch; **Taiwan:** Credit Suisse AG Taipei Securities Branch; **Indonesia:** PT Credit Suisse Sekuritas Indonesia; **Philippines:**Credit Suisse Securities (Philippines) Inc., and elsewhere in the world by the relevant authorised affiliate of the above.

Additional Regional Disclaimers

Australia: Credit Suisse Securities (Europe) Limited ("CSSEL") and Credit Suisse International ("CSI") are authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority ("FCA") and the Prudential Regulation Authority under UK laws, which differ from Australian Laws. CSSEL and CSI do not hold an Australian Financial Services Licence ("AFSL") and are exempt from the requirement to hold an AFSL under the Corporations Act (Cth) 2001 ("Corporations Act") in respect of the financial services provided to Australian wholesale clients (within the meaning of section 761G of the Corporations Act) (hereinafter referred to as "Financial Services"). This material is not for distribution to retail clients and is directed exclusively at Credit Suisse's professional clients and eligible counterparties as defined by the FCA, and wholesale clients as defined under section 761G of the Corporations Act. Credit Suisse (Hong Kong) Limited ("CSHK") is licensed and regulated by the Securities and Futures Commission of Hong Kong under the laws of Hong Kong, which differ from Australian laws. CSHKL does not hold an AFSL and is exempt from the requirement to hold an AFSL under the Corporations Act in respect of providing Financial Services. Investment banking services in the United States are provided by Credit Suisse Securities (USA) LLC, an affiliate of Credit Suisse Group. CSSU is regulated by the United States Securities and Exchange Commission under United States laws, which differ from Australian laws. CSSU does not hold an AFSL and is exempt from the requirement to hold an AFSL under the Corporations Act in respect of providing Financial Services. Credit Suisse Asset Management LLC (CSAM) is authorised by the Securities and Exchange Commission under US laws, which differ from Australian laws. CSAM does not hold an AFSL and is exempt from the requirement to hold an AFSL under the Corporations Act in respect of providing Financial Services. This material is provided solely to Institutional Accounts (as defined in the FINRA rules) who are Eligible Contract Participants (as defined in the US Commodity Exchange Act). Credit Suisse Equities (Australia) Limited (ABN 35 068 232 708) ("CSEAL") is an AFSL holder in Australia (AFSL 237237).

Malaysia: Research provided to residents of Malaysia is authorised by the Head of Research for Credit Suisse Securities (Malaysia) Sdn Bhd, to whom they should direct any queries on +603 2723 2020.

Singapore: This report has been prepared and issued for distribution in Singapore to institutional investors, accredited investors and expert investors (each as defined under the Financial Advisers Regulations) only, and is also distributed by Credit Suisse AG, Singapore Branch to overseas investors (as defined under the Financial Advisers Regulations). Credit Suisse AG, Singapore Branch may distribute reports produced by its foreign entities or affiliates pursuant to an arrangement under Regulation 32C of the Financial Advisers Regulations. Singapore recipients should contact Credit Suisse AG, Singapore Branch at +65-6212-2000 for matters arising from, or in connection with, this report. By virtue of your status as an institutional investor, accredited investor, expert investor or overseas investor, Credit Suisse AG, Singapore Branch is exempted from complying with certain compliance requirements under the Financial Advisers Act, Chapter 110 of Singapore (the "FAA"), the Financial Advisers Regulations and the relevant Notices and Guidelines issued thereunder, in respect of any financial advisory service which Credit Suisse AG, Singapore Branch may provide to you.

EU: This report has been produced by subsidiaries and affiliates of Credit Suisse operating under its Global Markets Division

In jurisdictions where CS is not already registered or licensed to trade in securities, transactions will only be effected in accordance with applicable securities legislation, which will vary from jurisdiction to jurisdiction and may require that the trade be made in accordance with applicable exemptions from registration or licensing requirements.

This material is issued and distributed in the U.S. by CSSU, a member of NYSE, FINRA, SIPC and the NFA, and CSSU accepts responsibility for its contents. Clients should contact analysts and execute transactions through a Credit Suisse subsidiary or affiliate in their home jurisdiction unless governing law permits otherwise.

CS may provide various services to US municipal entities or obligated persons ("municipalities"), including suggesting individual transactions or trades and entering into such transactions. Any services CS provides to municipalities are not viewed as "advice" within the meaning of Section 975 of the Dodd-Frank Wall Street Reform and Consumer Protection Act. CS is providing any such services and related information solely on an arm's length basis and not as an advisor or fiduciary to the municipality. In connection with the provision of the any such services, there is no agreement, direct or indirect, between any municipality (including the officials,management, employees or agents thereof) and CS for CS to provide advice to the municipality. Municipalities should consult with their financial, accounting and legal advisors regarding any such services provided by CS. In addition, CS is not acting for direct or indirect compensation to solicit the municipality on behalf of an unaffiliated broker, dealer, municipal securities dealer, municipal advisor, or investment adviser for the purpose of obtaining or retaining an engagement by the municipality for or in connection with Municipal Financial Products, the issuance of municipal securities, or of an investment adviser to provide investment advisory services to or on behalf of the municipality. If this report is being distributed by a financial institution other than Credit Suisse AG, or its affiliates, that financial institution is solely responsible for distribution. Clients of that institution should contact that institution to effect a transaction in the securities mentioned in this report or require further information. This report does not constitute investment advice by Credit Suisse to the clients of the distributing financial institution, and neither Credit Suisse AG, its affiliates, and their respective officers, directors and employees accept any liability whatsoever for any direct or consequential loss arising from their use of this report or its content. No information or communication provided herein or otherwise is intended to be, or should be construed as, a recommendation within the meaning of the US Department of Labor's final regulation defining "investment advice" for purposes of the Employee Retirement Income Security Act of 1974, as amended and Section 4975 of the Internal Revenue Code of 1986, as amended, and the information provided herein is intended to be general information, and should not be construed as, providing investment advice (impartial or otherwise).

Copyright © 2020 CREDIT SUISSE AG and/or its affiliates. All rights reserved.

When you purchase non-listed Japanese fixed income securities (Japanese government bonds, Japanese municipal bonds, Japanese government guaranteed bonds, Japanese corporate bonds) from CS as a seller, you will be requested to pay the purchase price only.